RAILROAD GAZETTE

FRIDAY, APRIL 27.

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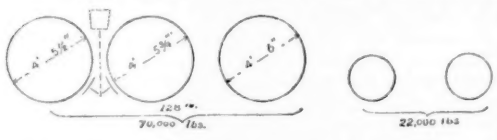
Contributions.

The Loss of Power Caused by Locomotive Drivers of Unequal Diameter.

TO THE EDITOR OF THE RAILROAD GAZETTE:

What would be the loss in pulling power of a 10-wheel engine whose wheels are not of the same diameter, as per accompanying diagram? The boiler pressure is 130 lbs. per



sq. in., and the main rods are connected to the centre driver.

The question may be of interest, as many similar cases are brought into shops daily. In other words, when should an engine go into shop for worn tires? A. D. B.

[Comment will be found in the editorial columns.—ED. RAILROAD GAZETTE.]

The Cause of Shock.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In view of the interest manifested in this subject and its bearing upon the possibility of a successful "buffer brake," I will venture a statement giving the result of my study of this subject.

There seems to be considerable misapprehension as to exactly what is ordinarily understood by shock in reference to train brakes. This I define as the collision or impact between two cars moving at different velocities; meaning by cars not the draw heads, but the car bodies or parts rigidly connected thereto. When the draw springs have been sent home, then the draw heads form a rigid mass for transmitting the "shock," and until this happens we do not have any shock. Either there is no shock or else it is felt. What might otherwise be quite a perceptible shock is often prevented by the action of the draw springs in modifying the relative velocities with which the cars tend to come together.

When two cars moving with different velocities come together we have, in the first place, a sudden change in velocity of each car, one being accelerated and the other retarded, thus causing the slideometer to move, and, secondly, we have a loss of what Weisbach calls "mechanical effect."

The change of velocity is expressed by the formula:

$$v = \frac{W_1 v_1 + W_2 v_2}{W_1 + W}.$$

Where v_1 and v_2 represent the velocity of the cars at the instant of impact, v the velocity of both cars just after impact, and W_1 and W_2 the weights of the impinging cars.

In regard to weight, we must remember that if all the slack of the forward car is taken up, we have the weight of rear car impinging against all the cars in front of it. In other words, if we have two cars of equal weight they will move after impact with a velocity the mean between the initial velocities of the two cars, while if one car impinges against a number of cars ahead of it, the velocity of the front cars will be but slightly accelerated, while the rear cars will be retarded an amount almost equal to the total difference in velocity of the cars at the instant of impact.

The slideometer measures the impact by indicating the amount of this sudden change of velocity in the rear car, and its movement, of course, is proportional to the square of this sudden change in velocity and would fairly represent the power of the shock for injury to stock, etc.

The loss of energy due to impact, which, if sufficient, is expended in destroying the cars, is represented by the formula

$$A = (v_1 - v_2)^2 \frac{M_1 M_2}{M_1 + M_2} = \frac{(v_1 - v_2)^2}{2g} \frac{W_1 W_2}{W_1 + W_2}$$

where v and W represent velocity and weight as before.

In other words, if the conditions as to mass or weight remain constant the shock is directly proportional to $(v_1 - v_2)^2$, the square of the difference in the velocity of the two cars at the instant of impact. To consider shock, then, we must first consider all the elements affecting the velocity of the cars before impact.

The motion of a car can most readily be considered by reference to a diagram in which one axis represents time, the other space or distance. Thus in figure 1 the line $O\,C$ represents a car moving with a uniform velocity of 50 ft. per second (about 35 miles per hour). If, however, a brake, exerting a uniform retarding effect, were applied at O, its movement would be represented by a curve $O\,B\,A$. In the first case the movement would be represented by the formula

$$d = v\,t$$

and in the second case by the formula

$$d = v\,t - \tfrac{1}{2}\,r\,t^2$$

where v = initial velocity, t = time, and d = distance or space passed through in the time t.

In practice we do not have exactly these conditions of a uniformly retarded movement on account of the fluctuations in the coefficient of friction of the brake shoes; still, for our present purpose, it will be sufficient to consider this as constant. Assuming this to be the case, we have the value of r for Carpenter brake in stops from 20 miles per hour (empty car train) as about 3.9, while for stops from 40 miles per hour as 3.7.

Assuming for r a constant value of 4, we have the curve $O\,B\,A$ representing the motion of a car from O with a velocity of 50 feet per second to A, where it is at rest. The velocity at any point is proportional to the tangent of the angle made by a line tangent to the curve at that point with the line $O\,D$. The curve $O\,B\,A$ is a parabola, and referred to the axis $A\,y$. $A\,x$ is represented by the formula

$$y^2 = \frac{2}{r}\,x.$$

If in this manner we represent the motion of two cars, the point at which such curves intersect would show the point of impact or shock, and the difference in the squares of the tangents of the angles at this point would be proportional to the amount or force of such shock or impact.

Let us consider the case of a train of cars of equal weight with ½ foot slack between cars and no draw springs or buffers. If we apply the brake instantly to the front car, this car then moves with a uniform retardation and the distance moved in any time t is $d = v\,t - \frac{1}{2}\,t^2$. The next car, however, continues to move with a uniform velocity, hence the two cars will collide when

$$\tfrac{1}{2} + v\,t = v\,t - \tfrac{1}{2}\,r\,t^2$$

or when

$$t^2 = \tfrac{1}{4}, \text{ or } t = \sqrt{\tfrac{1}{4}} = \tfrac{1}{2}$$

In other words, the second car impinges upon the first car at the end of ½ second. The velocity of the front car at this instant is $v = v - r\,t = 50 - 2 = 48$. The rear car, however, has still the velocity of 50 ft. per second. We, therefore, have a shock due to a difference of velocity of 2 feet per second.

After impact both cars continue with a velocity of 49 ft. per second, which is uniformly retarded, but as the brake now acts on two cars with same force as before on one car, the value of r is now only half its former value and the next impact must be calculated with this value of r. In this manner we find the following when the brake is applied on front car only:

Impact between cars.	Velocity of forward car. Ft. per second.	Velocity of rear car. Ft. per second.	Difference in velocity. Ft. per second.	Time between impact. Seconds.
1 and 2	48.	50.00	2.00	.50
2 and 3	48.27	50.00	1.73	.37
3 and 4	48.37	50.00	1.63	.36
4 and 5	48.41	50.00	1.59	.35
5 and 6	48.45	50.00	1.54	

In other words, we have the successive impacts occurring with less difference in velocities and as shock is proportional to square of difference in velocities, we readily see why, as in stop 251, no severe shock was felt in rear car. This holds good even after allowing for the greater mass or weight, and consequent retarding force, of the engine as compared with a car.

If in similar manner we calculate the velocities or impact under the supposition that the brakes apply on each car just

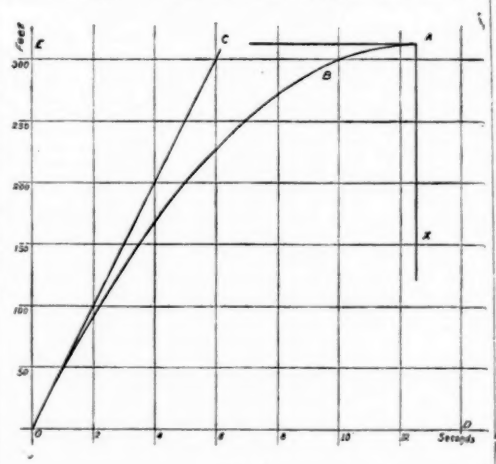


Fig. 1.

after it has collided with the car ahead, somewhat as would be the case with the ordinary buffer brake, we then have:

Impact between cars	Velocity of front car. Ft. per sec.	Velocity of rear car. Ft. per sec.	Difference in velocity. Ft. per second.	Time between shocks.
1 and 2	48.	50.00	2.00	.50 seconds.
2 and 3	47.76	50.00	2.24	.31 "
3 and 4	47.50	50.00	2.50	.25 "
4 and 5	47.06	50.00	2.94	.22 "

In other words, the difference in velocities at impact is now constantly increasing, and the shock which is proportional to the square of this difference of velocity gradually increases, and is greatest at the rear end of the train.

For the purpose of representing these cases graphically I prefer to represent one axis as corresponding to the initial

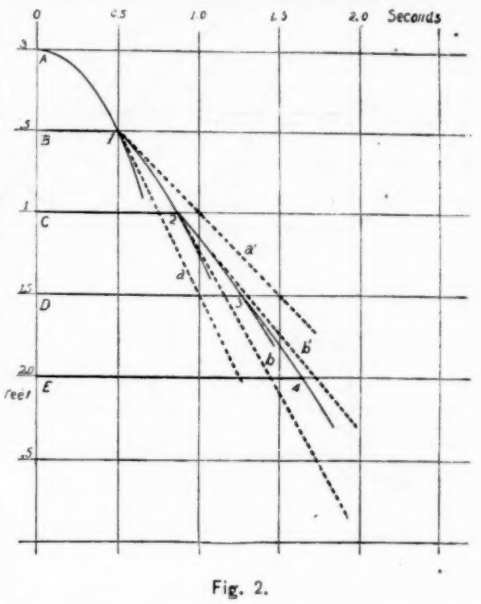


Fig. 2.

velocity, and represent the retardation from time of applying the brake by ordinates at right angles to this axis, thus the motion of the car shown in Fig. 1 would be represented by a curve whose ordinates were equal to the distance between the line $O\,C$ and the curve $O\,B\,A$, but, as we have shown, this distance represents the retardation, and is equal to $\frac{1}{2}\,r\,t^2$.

In fig. 2 I have represented the first case of a brake applied to front car only. A, B, C, D and E represent five cars; the distance between these points represent the slack between the cars. All the cars are moving with the same initial velocity and the motion of each car is, therefore, represented by a straight line, as $C\,2$ or $E\,4$. At A the brake is applied to this car, which is now uniformly retarded, describing the curve repre-

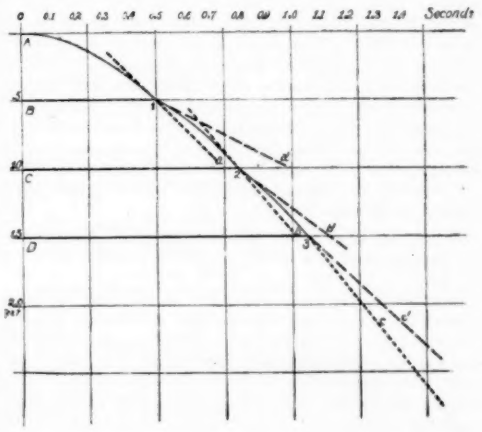


Fig. 3.

sented by the formula $R = \frac{1}{2}\,r\,t^2$ where R is the total retardation in the time t, and r is the rate of retardation due to the brake. When this curve is intersected by the line $B\,1$ we have the impact due to the unbraked car B, impinging upon the braked car A. The velocity of the car B, in reference to the car A, is proportional to the tangent of the angle of intersection, as shown by the tangent $1\,a$. Immediately after impact both cars have the velocity relative to the initial velocity and the velocity of the remaining cars, as represented by the line $1\,a'$, but the brake on the front car now retards both cars along the line 1, 2, and at 2 we have the impact of the third car. The velocity of impact is represented by the line $2\,b$, the resulting velocity by line $2\,b'$. The next impact occurs at the point 4, where the relative velocity of the cars, or the velocity of impact, is still less. A mere inspection of such a diagram will show that the velocity of impact grows constantly less, and therefore, in a long train the shock in the last car is slight, even with a powerful engine brake.

Fig. 3 represents a similar diagram for the case where the brake is applied on each car immediately after the impact of such car. (The horizontal scale in fig. 3 for convenience is twice that of fig. 2.) As before, the velocity of impact is proportional to tangent of angle of intersection. This for the impact between first and second cars is same as in previous case, and is represented by the line $1\,a$, the resulting velocity with which both cars move, shown by line $1\,a'$, is also the same as before, but as brakes are now applied to both cars the value of r remains the same as for the first car, i. e., $r = 4$, while in previous case it was equal to one-half of its value before impact, or $= 2$. In consequence of this the velocity of impact at 2 (shown by line $2\,b$) is greater than at 1, while in former case it was less. In other words, if we apply the brakes only to front car, the velocity of impact decreases; while, if the brake is applied to each car immediately after

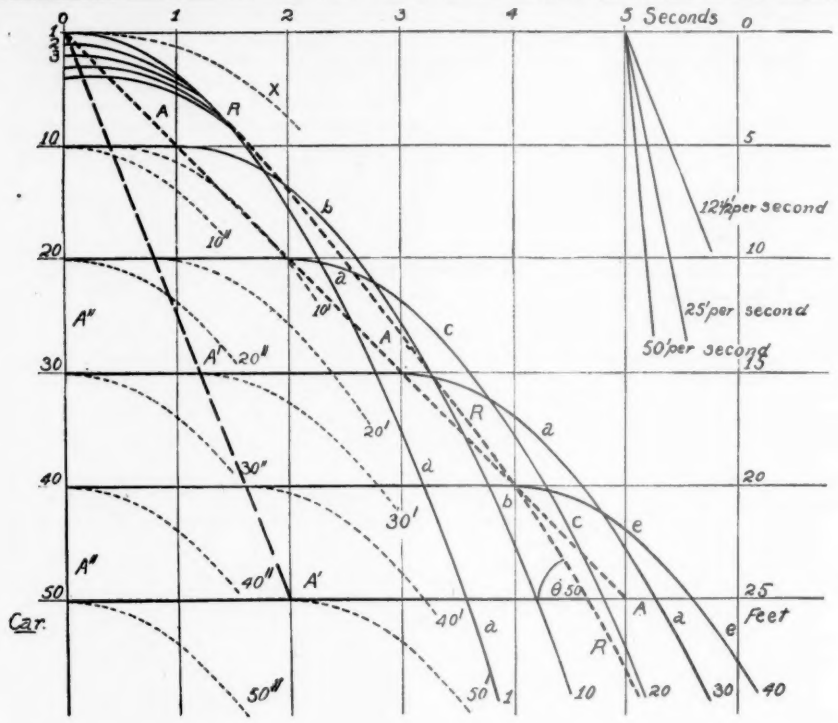


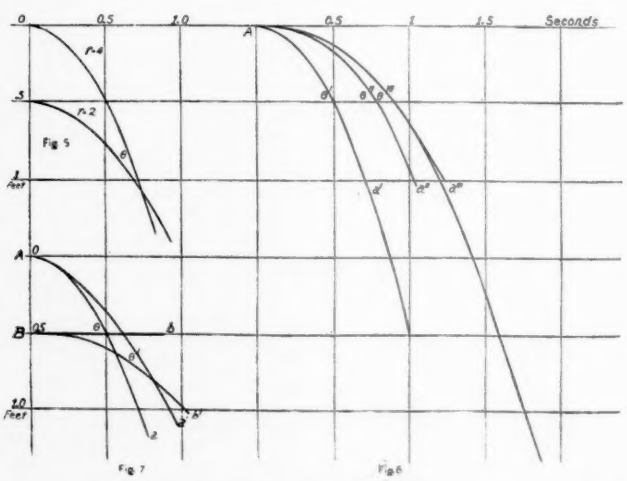
Fig 4

the impact of that car, the velocity of impact is constantly increasing, so that the shock is most severe in the last car.

Let us now consider such a case as the Westinghouse brake as tested at Burlington in 1887 on a 50-car train, assuming that the brake was applied on the rear car in 5 seconds after brake applied on the engine. If the value of r as before is taken as constant at 4, then the motion of any car, after application of the brake, if such car were moving independently, would be represented by a parabola as 1 *a a a* 1 (Fig. 4). If, as stated, we assume that it took 5 seconds to apply the brake on rear car, and that the successive intervals of time between application of brakes on different cars were uniform, such application would be represented by the line 1 *A A A*. The motion of car 10 would, if independent, be represented by the parabola 10 *b b* 10; that of car 20, by 20 *c c* 20; of car 30, by 30 *d d* 30, etc. But after the successive cars have impinged upon car 1 they all move along as one car, and the combined or resulting motion is represented by a line, as 1 *R R R*, and the shock for each impact is proportional to square of difference between the tangent of the angle made by the line representing the independent motion of that car at the point of impact and the tangent of the angle of the curve 1 *R R R* at same point; or to the square of the velocity of impact. Thus the impact in last car is proportional to the square of the tangent of the angle θ 50.

For purpose of comparison I have shown at one side lines representing velocities of impact of 50, 25 and 12.5 ft. per second.

If we change the brake apparatus so that the brake applies on the last car two seconds after application on front car, then the line of application would be represented by the line 1 *A′ A′*. The curve for the motion of car 1 is as before, 1 *a a* 1, but for cars 10, 20, 30, etc., we have the curve 10, 10′, 20, 20′, 30, 30′, etc. The resulting curve, instead of being along the line 1 *R R R*, is now along a curve but slightly beyond the curve 1 *a a a*, and a mere inspection of the diagram



will show that the velocity of impact of rear car and consequent shock is very slight. If the application of the brake is instantaneous throughout the train, the line of application will be represented by the line 1 *A″ A″*, the curves for the various cars by 1 *a a a* 1, 10, 10″, 20, 20″, 30, 30″, etc., and as none of these curves would ever intersect, the cars would not come together, and we would, therefore, have no shock.

With such a diagram we can study the effect of changing the rapidity with which the brakes are applied on the successive cars, and I think this serves to illustrate and explain why the shock with the Westinghouse train, as tested at Burlington in 1887, was more severe than with the train as tested in 1886, why again the recent improvements in the Westinghouse brake have so materially reduced this shock, and why instantaneous application throughout the train, under these conditions, will entirely prevent shock.

Of course there are many influences modifying the effects as here shown, and it must be borne in mind that the figures and curves given are for entirely imaginary conditions, such as cars without draw-springs, brakes which exert their maximum force instantly they are operated, coefficient of friction of brake shoes constant, etc.; still they serve to show the general principles upon which a study of this question of shock must be based.

Let us now consider some of these modifying influences. In the first place, if we have a loaded and an empty car and apply the brakes to both instantly, as the weight of one car is, say, twice that of the other, while the brake force in both cases is the same, then the value of r in one case is 4, while in the other only 2. The curves representing the movement of such cars would, therefore, be as in fig. 5, and we see that the angle of intersection is very slight, even in such a case as represented with 6 in. of free slack.

If we have two cars with the brake applied to one car only, with 6 in. free slack originally between these cars, then the shock is represented by the angle θ, fig. 7. But if the slack is all spring slack, then as soon as the brake is applied to the forward car there is a certain retardation of this car and a tendency for the cars to come together as just shown, but this compresses the draw springs, which retards the rear car, while it accelerates the forward car a proportionate amount, so that the two cars, instead of moving along the lines *A a* and *B b*, now move along the lines *A a′* and *B b′*, and the angle θ′ is much less than the angle θ and consequently the shock is much less. If the draw springs were sufficiently powerful, the cars, although approaching each other, would never come together, and all shock would, therefore, be avoided. If we apply this action of the draw spring to the case represented in fig. 5, we can readily see why it is that with electric application no shock is experienced, even though the brake is not proportioned to the weight of the car; still even with such electric application, if there is an *excessive* difference in the proportionate braking force, we may still have a considerable shock.

Again in no brake, certainly not in any air brake, does the brake force immediately rise to the maximum. In the Carpenter brake, as tested at Burlington, it took probably three seconds to reach the maximum after the brake valves were actuated, and during this time the brake pressure rises gradually in the cylinder. In Fig. 6 the curve, *A a′*, represents the retardation when r is constant at 4 from the very beginning; or, in other words, when the maximum brake force is exerted at once. All the diagrams have been drawn with this assumption. If, however, during the first ¼ second r = 1, during the second quarter = 2, during the third = 3 and the fourth quarter = 4, then the curve would be as represented by *A a″*. This would approximately represent the condition of affairs when it took ¾ second to fill the brake cylinder to the maximum pressure. In like manner curve *A a‴* represents the retardation when cylinder fills in about 1½ second. The bearing of this gradual filling of the air cylinder upon the shock is apparent at once, and its importance is, I believe, usually overlooked. In Fig. 4 the curve 1 *x* represents the curve as modified to allow for this gradual filling of the brake cylinder, assuming that the maximum was reached in about ¾ second.

Again, we must consider the action of the draw spring in connection with the rapidity with which successive impacts occur. Thus, if these impacts are in rapid succession, the draw springs will not have time to expand and separate the cars so that each successive car collides with all the cars in front of it, while, on the other hand, if, after the draw spring has been driven home, there is sufficient time to allow the spring to expand again before the next impact occurs, a part of this impact is absorbed by the compression of this spring. This modifies the values that we must give to W in the foregoing formulas for impact.

The shock is entirely independent of the fact whether the cars are braked or unbraked, excepting so far as this may affect the values to be given to W. Thus, if a car impinges upon another car to which the brakes have been applied, we would probably have to consider the value of W in our original formulas for the braked car as greater than that of the unbraked car, though both weigh the same, by the amount equivalent to the frictional resistance of the brake.

We have seen that the shock or impact is dependent upon, *first*, the weight or mass of the colliding cars, and in this connection we must consider the effect of cars ahead of the cars between which the impact occurs, and also the effect of such brakes as may be applied to these cars; *second*, the relative velocities with which such cars come together, or the velocity of impact. This is the more important element, and it must be remembered that the shock is proportional to the square of this velocity of impact.

The velocity of impact between any two cars is determined by many different elements, the more important of which are:

a. The slack between the cars, and we can say in this connection that, other things being equal, the shock will vary about as the square root of the slack.

b. The time of application of the brakes to each car; and we may here say that the shock in the rear car is a minimum when the application of the brake is simultaneous throughout the train, and maximum when the brake applies to the rear car just after the impact of that car; and after this the slower the successive application of the brakes the less the resulting shock.

c. The retarding force of the brake at each instant after the brake is applied, which is determined by the brake pressure and its proportion to the weight of the car, and the coefficient of friction of the brake shoes.

d. The action of the draw springs as modifying the velocity with which the cars come together.

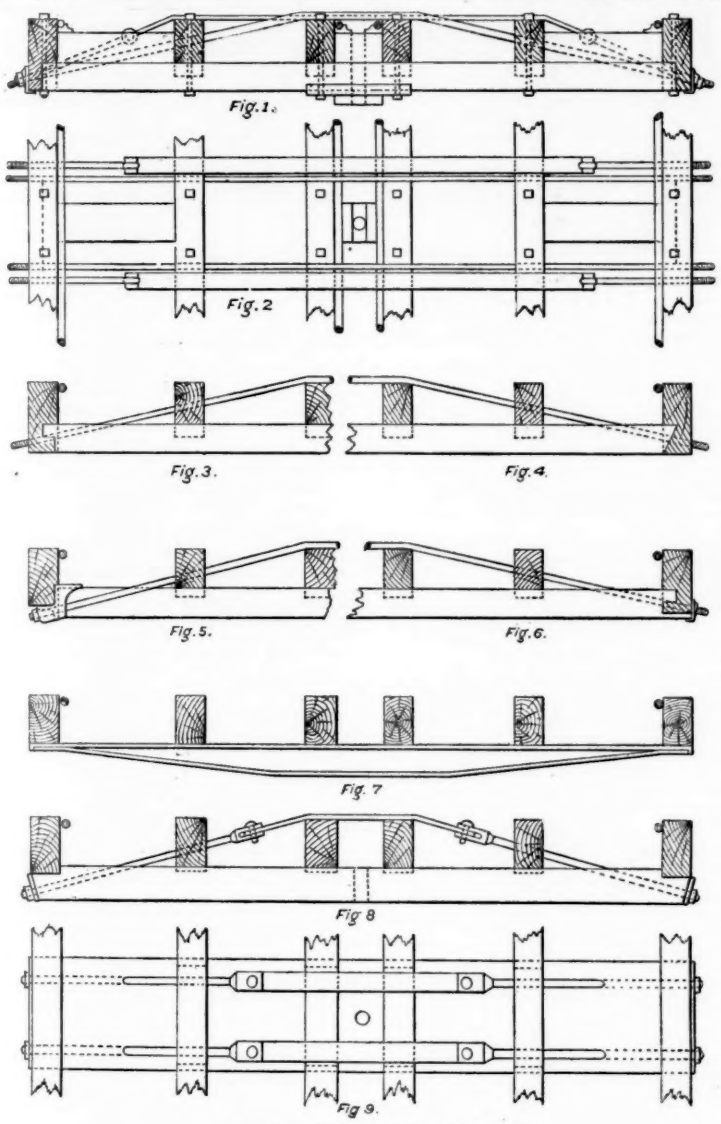
H. HOLLERITH.

Freight Car Body-Bolsters.

The accompanying illustrations represent a series of freight car body-bolsters or transoms. Fig. 1 is the elevation and fig. 2 is the plan of a standard method of an extensive railroad. The body-bolster is oak, 4 in. × 12 in.; its whole size is let into the side sill 2 in., and it is trussed by two 1-in. rods with 1¼-in. ends, running along the edges of the body-bolster and passing through the side sills, with a cast-iron washer plate on outside of sill, as shown in cut. These two rods were not sufficient to hold up the ends of the bolster, consequently, another set of trussing was introduced and adopted, which consists of a flat iron strap, ½ in. × 4 in., extending across the two intermediate stringers and connected with an eye-bolt at each end, the eye-bolts being confined to strap by ¾ in. key-bolts, as shown. The eye-bolts are also 1 in. dia., with 1⅛ in. ends, and pass through the side sills, with cast-iron washer plates at their ends; even this additional trussing does not overcome the trouble. The side sills, of course, are held up, for it is almost impossible to resist this powerful truss, but the bolster droops down at the ends, which is caused by the strain of the hog rods, the bearings being at the extreme ends of the bolster, as shown. This destroys all the play at the side bearings, in fact nearly the whole weight of body, together with its load, is thrown upon them. The truss does not act upon the bolster, but upon the sills, holding them hard up, while the hog-rods strain the ends of the bolster down.

If it is absolutely necessary to frame a bolster into a sill, their bottom being flush, a better way is shown in fig. 3, which is what is called a bareface tenon; the thickness being half the thickness of the bolster, length being half the thickness of the sill, and the width being one third the width of the bolster. Two tenons being used on each end, flush with the edges. The whole size of the bolster let into the sill ¼ in., as shown.

Fig. 4 shows a still better method. The ends of the bolster



FREIGHT CAR BODY BOLSTERS.

are cut on an angle. The top part is let into the sill half its thickness, the bottom being even with the inside of sill, as shown.

Figs. 5 and 6 represent bolsters that partly extend below the side sills. Fig. 5 is provided with a cast-iron bracket, the inside forming a pocket which fits over the end of the bolsters with a projection on the outside to receive the side sill. The truss-rods pass along the outside edges of the bolsters and through the bracket as shown. Fig. 6 shows a more rigid and inexpensive way of connecting the bolsters with side sill, the truss-rods passing through the bolster.

Fig. 7 represents the iron bolster. This is a very good design, but is so narrow that it does not afford sufficient bearing for the sills and stringers, and the cost over the wooden bolster must necessarily be another objection.

Figs. 8 and 9 show in elevation and plan a bolster which is very extensively used. This is a very satisfactory design. It is made of oak, 6 in. × 16 in. The truss-rods pass through the stick, the inner ends connect with a strap ½ in. × 4 in., which lays on top of centre stringers as shown. It may be noted that these straps should never extend to the intermediate stringers as they do in fig. 1. When they do the virtue of the truss is destroyed. For a car of 40,000 lbs. capacity, the rods should be 1 in. dia., with 1¼ in. ends. These rods should be screwed up until the ends of the transom stand ¼ in. higher than the centre, and the stringers so arranged as to make the floor straight. In this arrangement the top of the side sills stands 7 in. from the top of the bolster, the distance above the top of intermediate stringers being 7⅛ in., and the top of the centre stringers 7¼ in.

Train Accidents in March.

COLLISIONS.

REAR.

1st, on New York, Lake Erie & Western, in Corning, N. Y., a freight ran into a preceding freight, damaging a caboose.

2d, on Missouri Pacific, in St Louis, Mo., an engine which had been standing in the roundhouse for an hour since coming in from its trip, was suddenly started, apparently by a leaky throttle valve, and rushed through the yard at a high speed. After running some distance it collided with a switching freight, which had an engine at each end. The enginemen of the switching freight had seen the danger and increased their speed to escape it; but they soon found that their own train was beyond control, and the forward engine was pushed off the end of the track and wrecked.

2d, on New York Central & Hudson River, at Sing Sing, N. Y., a freight train ran into a preceding freight which had stopped to do some switching, damaging engine and several cars. The second train was flagged, but could not be stopped.

3d, on New York, Lake Erie & Western, near Jersey City, N. J., freight ran into a preceding freight, wrecking engine and several cars.

4th, on Ohio & Mississippi, at Sparksville, Ind., a freight train ran into a preceding freight; engine, caboose and several cars wrecked.

5th, on Norfolk & Western, at Pulaski, Va., passenger train ran over a misplaced switch and into some freight cars standing on a siding, doing slight damage.

6th, on Southern Pacific, at Delano, Cal., a freight ran into a preceding freight, derailing and damaging three cars.

6th, on New York, Lake Erie & Western, in Newburgh, N. Y., a yard engine ran over a misplaced switch into some freight cars, doing considerable damage.

6th, on Kansas City, St. Joseph & Council Bluffs, near Nebraska City, Neb., a passenger train ran into the rear of a freight train, which had been derailed by a tie maliciously placed across the track, wrecking engine, caboose and several cars; engineer and fireman injured.

6th, on Philadelphia & Reading, near Auburn, Pa., a coal train broke in two and the rear section ran into forward one, wrecking several cars.

10th, on Philadelphia & Reading, near Reading, Pa., a freight train which had stopped for water was run into by a closely following freight, the engineman of the second train apparently failing to observe that the signal was turned against him; engine disabled and several cars derailed and damaged.

10th, on Philadelphia & Reading, near Royersford, Pa., a freight train ran into a car which had become detached from a preceding freight. The engine was thrown over on its side and a number of cars were badly wrecked; 1 trainman killed and another injured.

10th, on Southern Pacific, near Railroad Pass, Ariz., a freight train which had stopped to enable its locomotive to generate the necessary steam for ascending a heavy grade, was run into by a following freight train, piling up the engine, caboose and several cars in a bad wreck. A flag sent back was disregarded.

11th, on Newport News & Mississippi Valley, near Quinnimont, W. Va., a passenger train ran into a caboose and several cars which had broken loose from a preceding freight train, doing considerable damage; engineer injured.

12th, on Manhattan Elevated, in New York city, passenger train ran into the rear of another passenger train stand ind at the 23d street station of the Sixth avenue line, doing slight damage.

12th, on New York Central & Hudson River, at Dobbs Ferry, N. Y., a south-bound express train, standing at the station was run into by a following passenger train. A furious snowstorm was raging at the time. The person in charge of the station asserts that he pulled the station distant signal to danger immediately after the arrival of the first train. Four passengers were injured.

12th, on Manhattan Elevated, in New York City, rear collision between passenger trains, killing an employé who was riding on an engine to his work, and injuring 7 passengers. About 7 a. m. (during the severe snowstorm) a southbound train on the Third avenue line was stopped just after starting from the station at Seventy-sixth street, which is in a hollow, the ascending grade each way being about 95 ft. to the mile. The next following train, (which had 2 engines at the front but none at the rear, as reported), was ordered to pass this station without stopping, in order to prevent stalling on the ascending grade. It appears, however, from the statements of the officers of the road that the enginemen were not unmindful of their duty to keep the speed under control and the brakes were applied some 800 ft. north of the rear end of the standing train; but the slipperiness of the track and the icy condition of the brake rigging had not been properly appreciated and the second train collided with the first with such force as to derail and badly damage the engines.

13th, on Pennsylvania, near Rye, Pa., a freight train ran into a preceding freight, damaging engine and 3 cars; a brakeman injured.

14th, on Camden & Atlantic, in Camden, N. J., four empty engines, three of which were running backwards, were piled in a heap and badly damaged by reason of the derailment of the foremost. It appears that the engines were following each other so closely that there was not space enough for them to stop in after seeing the obstruction ahead. Several of the men jumped, but escaped uninjured.

15th, on Louisville & Nashville, at Crescent Hill, Ky., passenger train struck a freight car which projected over the main track from a siding, damaging engine and several cars.

16th, on Baltimore & Ohio, near Attica, O., a freight train into a preceding freight, wrecking engine, caboose and 4 cars.

16th, on Grand Trunk, at Romeo, Mich., a freight train ran into a cattle car which had been maliciously pushed out of a siding so as to obstruct the main track; engine and 15 cars derailed, the former being badly wrecked.

16th, on Pennsylvania, in Philadelphia, Pa., a mail car at the rear of a passenger train was run into and considerably damaged by a closely following locomotive which was going to a roundhouse; 4 trainmen injured.

17th, on Boston & Albany, at Newton, Mass., a freight train ran over a misplaced switch through a cross-over track and collided with a passenger train; engine and several cars derailed and damaged.

20th, on Chicago & Alton, near Whitehall, Ill., a passenger train which had stopped for the purpose of making repairs on the engine was run into by a following freight train, doing considerable damage. The engineer of the passenger train was underneath his engine at the time and was instantly killed. The freight was flagged when a mile distant, but it was descending a heavy grade, and was not stopped in time to prevent dashing into the standing train.

22d, on Chicago & Alton, near Roodhouse, Ill., freight train ascending a grade broke in two and rear section ran back into the head of a following passenger train, damaging engine and several cars, and injuring a trainman.

21st, on New York, Lake Erie & Western, near Jersey City, N. J., a passenger train collided with an engine standing on the main track.

24th, on Chicago, Milwaukee & St. Paul, at Elk River Junction, Ia., a freight train ran into a preceding freight, wrecking engine and several cars. The wreck caught fire and was partially consumed.

24th, on Burlington & Missouri River, at Curtis, Neb., a special passenger train ran into the rear of a freight train going into a siding, wrecking engine, caboose and several cars. The wreck caught fire and was partially consumed. A blinding storm of rain and sleet prevailed at the time.

26th, on New York, Lake Erie & Western, near Mast Hope, Pa., a freight train broke in two and the rear section ran into the forward one on the bridge over Delaware River, wrecking several cars and damaging the bridge.

26th, on Illinois Central, near Tuscola, Ill., a freight train ran into the rear of an accommodation train, damaging a passenger car; 1 passenger injured.

27th, on Cincinnati, New Orleans & Texas Pacific, at Danville Junction, Ky., passenger train ran into the rear of a freight train which was going into a siding, damaging engine, caboose and several cars.

27th, on West Jersey, at Glassboro, N. J., passenger train ran into the rear of a freight train, damaging engine and caboose.

28th, night, on Missouri Pacific, at Dickinson, Tex., passenger train ran into the rear of a preceding passenger train, damaging the rear car; 1 passenger injured.

28th, on New York Central & Hudson River, in Syracuse, N. Y., passenger train ran over a misplaced switch and into a freight car standing on a side track, doing some damage; 1 trainman injured.

30th, on Louisville & Nashville, near Harrod's Creek, Ky., passenger train ran into a freight car standing on the main track.

BUTTING.

4th, on Cincinnati, New Orleans & Texas Pacific, near Pine Knot, Ky., butting collision between a passenger train and a freight, wrecking the engines and throwing 10 cars over an embankment; 1 trainman killed, 5 trainmen and a tramp injured. The freight was running in violation of orders.

6th, on Iowa Central, near Hampton, Ia., butting collision between two freight trains, due to dispatcher's mistake, wrecked both engines and 19 cars; 2 trainmen fatally injured.

6th, on Pennsylvania, near Johnstown, Pa., a freight train going on to the main track from a siding ran into an empty passenger train which had also started for the main track, wrecking 19 cars; 1 trainman killed, 2 injured.

7th, on St. Louis, Keokuk & Northwestern, near Hannibal, Mo., butting collision between two passenger trains, disabling the engines.

7th, on Chicago & Northwestern, at Wrightstown, Wis., butting collision between two freights, wrecking both engines.

8th, on Pennsylvania, in Philadelphia, Pa., two empty switching passenger trains collided, damaging an engine and several cars, and injuring 2 trainmen.

8th, on Burlington & Missouri River, at Humbolt, Neb., butting collision between two passenger trains, one of which approached the station at too high a speed, injuring 3 trainmen and 2 passengers.

9th, on New York, New Haven & Hartford, in Hartford, Conn., a southbound passenger train just leaving the station ran over a misplaced switch and through a cross-over track into a northbound passenger train which was standing on the opposite main track. One car was badly damaged, but no passengers hurt.

10th, on Chicago, Milwaukee & St. Paul, at Brookfield, Wis., butting collision between two freight trains, wrecking the engines and several cars.

12th, on Florida Southern, near Pemberton, Fla., butting collision between a passenger train and a freight wrecked both engines; 1 trainman killed.

13th, on Charleston, Cincinnati & Chicago, near Camden, S. C., butting collision between two construction trains, wrecking the engines and several cars; 1 trainman killed and 2 fatally injured.

14th, on Louisville & Nashville, near Blount Springs, Ala., butting collision between two freight trains, wrecking the engines and 10 cars; 3 trainmen injured.

15th, on Columbus & Rome, at Bangor, Ala., butting collision between two freights, wrecking both engines.

15th, on Central Pacific, at Borden, Cal., a butting collision between two freight trains wrecked both engines.

15th, on Alabama Great Southern, near Trussville, Ala., butting collision between a local passenger train and a freight train on a curve, owing to misunderstanding of

orders, wrecking both engines; 1 trainman killed, 2 injured.

16th, on Union Pacific, at Bronson, Neb., butting collision between a passenger train and a freight train.

17th, on New York, Pennsylvania & Ohio, at Meadville, Pa., butting collision between two passenger trains on a curve in the yard wrecked both engines and several cars of each train, the wreck taking fire; 1 trainman killed, 1 injured.

19th, on Central Pacific, near Cisco, Cal., butting collision between two heavy freight trains, wrecking 4 engines and several cars; 1 trainman killed and several injured.

21st, on Missouri Pacific, near Leavenworth, Kan., butting collision between two freight trains, wrecking both engines and several cars, and injuring a brakeman.

22d, on Pittsburgh & Lake Erie, near Mahonington, Pa., butting collision between two freight trains, wrecking both engines and 13 cars. Several trainmen escaped injury by jumping into Mahoning River.

23d, on Pittsburgh & Lake Erie, near Wampum, Pa., butting collision between two passenger trains, wrecked engines of both trains, 1 trainman killed, 8 trainmen and 2 passengers injured. The collision was caused by a mistake in orders.

24th, on Baltimore & Ohio, at Littleton, W. Va., butting collision between two passenger trains, damaging both engines and several cars; 1 passenger injured.

24th, on Southern Pacific, at Aurant, Cal., butting collision between two freights, due to a misplaced switch, wrecked both engines and 7 cars.

27th, on New Yark, Lake Erie & Western, at Newburg Junction, N. Y., butting collision between two passenger trains disabled both engines. There was a thick fog at the time.

27th, on Burlington & Missouri River, at Smartville, Neb., butting collision between two freights, damaging both engines.

28th, on Pennsylvania, near Green Tree, Pa., butting collision between two freight trains wrecked both engines.

CROSSING.

19th, at the crossing in Yorktown, Pa., a Lehigh Valley passenger train ran into a Central of New Jersey coal train; engine and several cars wrecked.

21st, at the crossing in New Ross, Ind., an Ohio, Indiana & Western freight train collided with an Indiana Midland freight, wrecking an engine and 9 cars.

27th, night, at the crossing near Burnside, Ill., a Toledo, Wabash & Western freight train ran into a Michigan Central passenger train, derailing and damaging the rear car; six passengers injured.

DERAILMENTS.

DEFECTS OF ROAD.

1st, on Southern Pacific, near Hondo, Tex., the caboose and a car of a freight train fell into a creek, the bridge over which had been impaired by a piece of timber which had fallen from a car of a previous freight train bound in the opposite direction, breaking one of the struts; 2 trainmen and a man riding in the caboose killed, 1 trainman fatally injured. The conductor of the wrecked train had been cautioned by the conductor of the freight from which the timber fell to stop and examine the bridge before venturing to cross, but he failed to do so.

5th, on Chicago, Milwaukee & St. Paul, near Gault, Mo., 5 cars of a freight train thrown from the track by a broken rail.

6th, on Central Pacific, at Fenelon, Nev., passenger train thrown from the track and several cars wrecked by the spreading of the rails.

8th, on Alabama Great Southern, near Fort Payne, Ala., a car of a passenger train was thrown from the track by a broken rail and overturned, injuring 2 passengers.

9th, on Union Pacific, near La Salle, Col., a passenger train running at high speed was thrown from the track by a broken rail, considerable damage done and a trainman and a passenger injured.

11th, on New York, Lake Erie & Western, near Scio, N. Y., engine and 2 rear (sleeping) cars of a passenger train were derailed, it is stated, by a low joint, due to the softening of the ground by thaw. Owing to the slippery condition of the track the train was not stopped promptly and the derailed cars were badly damaged, having been meantime hurled against a brick water tank, the station platform and a wooden water tank, moving the latter several feet on its foundation. One passenger killed and 9 injured.

12th, on Philadelphia & Reading, near Shamokin, Pa., several cars of a freight train were thrown from the track by a broken rail and badly wrecked.

12th, on New York, Lake Erie & Western, at Erwin's, N. Y., freight train thrown from the track by a broken rail.

14th, on Lehigh Valley, near Three Bridges, N. J., a work train, consisting of 3 engines, 2 cars filled with snow shovelers and a fourth engine pushing, was derailed on a curve in a deep snowdrift. It is said that a broken rail was the cause. Three men were killed and 4 injured.

14th, on Philadelphia & Reading, near Tamaqua, Pa., 2 cars of a passenger train derailed by a broken frog and thrown off a bridge into a creek bottom side up; 1 trainman killed and 2 trainmen and 6 passengers injured.

15th, on West Shore, near Port Jackson, N. Y., passenger train thrown from the track by a broken rail, wrecking express and baggage cars, the latter being thrown on its side; 3 trainmen injured.

17th, on Northern Pacific, near Rosebud, Mont., a portion of a freight train broke through a trestle which had been weakened by a freshet.

28th, on Missouri Pacific, near Bastrop, Tex., engine and several cars of a construction train went through a bridge; 1 trainman killed, and 1 trainman and 6 laborers injured.

DEFECTS OF EQUIPMENT.

2d, on Louisville & Nashville, in Nashville, Tenn., 2 cars of a freight train were derailed on a trestle by a fallen brake-beam, the wheels of the cars going through the floor system. The cars were thrown off the trestle to facilitate clearing the track.

2d, on Grand Rapids & Indiana, near Fort Wayne, Ind., 9 cars of a freight train were derailed by the breaking of a wheel, injuring a brakeman and a man riding in the caboose.

5th, on Central of Georgia, at Jackson, S. C., several cars in a freight train derailed by the breaking of an axle.

12th, on Wisconsin Central, near Chippewa Falls, Wis., 8 cars of a freight train were derailed and wrecked by the breaking of a wheel.

16th on Lake Shore & Michigan Southern, near Ligonier, Ind., 20 cars of a freight train were derailed by the breaking of an axle and badly wrecked. The wreck was fired by the explosion of a quantity of naphtha and was consumed.

16th, on Cincinnati, Indianapolis, St. Louis & Chicago, at Cincinnati, O., forward axle of a switch engine broke, causing it to swing around across an adjoining track; 1 trainman injured.

21st, on Delaware, Lackawanna & Western, near Andover, N. J., forward engine of snowplow train thrown from the track by the breaking of an axle and badly damaged.

22d, on Pennsylvania, at Barre, Pa., an axle of a car in a freight train broke, and 15 cars were derailed and badly wrecked, part of the derailed cars striking the station building, demolishing it completely. A telegraph operator jumped out of a window, and escaped with slight injury; 2 trainmen and 2 tramps killed, 3 tramps injured.

23d, on Detroit, Grand Haven & Milwaukee, near Birmingham, Mich., 5 cars of a freight train derailed and wrecked by a broken truck.

26th, on Central Pacific, near Truckee, Cal., 2 cars of a freight train derailed by the breaking of a journal.

31st, on Annapolis & Baltimore Short Line, at Revells, Md., a car in a passenger train was derailed and ditched by a spring which dropped out of one of the trucks of the tender and caught in a road crossing; 1 trainman and 8 passengers injured.

NEGLIGENCE IN OPERATING.

4th, on New York, Lake Erie & Western near Jersey City, N. J., a freight train drawn by two engines and running fast derailed by a misplaced switch. Both engines and 12 cars were wrecked.

5th, on Burlington & Missouri River, at Lincoln, Neb., a car of coal in a switching train was backed off a trestle, falling 25 ft.

15th, on Southern Pacific, near White Water, Cal., freight train derailed by a misplaced switch and 13 cars wrecked. The wreck caught fire and was partially consumed. Two trainmen killed.

15th, on Denver & Rio Grande, near Montrose, Col., passenger train derailed by a misplaced switch and the engine thrown on its side and wrecked; fireman killed, engineer injured.

16th, on Southern Pacific, near San Bernardino, Cal., passenger train derailed by a misplaced switch, presumably turned by some malicious person.

22d, on Union Pacific, near Como, Col., several cars of a runaway freight train derailed and badly wrecked, tearing away a portion of a snow-shed; 2 trainmen injured.

22d, on Portland & Willamette Valley (narrow gauge), near Oswego, Ore., as a mixed train, consisting of engine, 2 loaded stock cars, baggage car and a passenger coach, neared a trestle on a sharp curve, the second car jumped the track and ran along over the sleepers until about half way across the trestle, when the forward coupling of the derailed car gave way and it was tipped off, dragging the other cars down after it, falling 16 ft. The cars were badly wrecked; conductor and 12 passengers injured. It is said that when rounding the curve the outer wheels of the forward truck of the derailed car were raised by the cattle lurching toward the lower or inside of the curve, allowing the inner wheels to run off the rails.

30th, night, on Burlington & Missouri River, a string of cars was maliciously started out of a siding at Sheely Station, Neb., the brakes having been let off, and run down grade on the main track. At South Omaha, some miles distant, the cars were derailed by a switch which was not right for them and 6 of them were badly wrecked.

UNFORESEEN OBSTRUCTIONS.

3d, on Green Bay, Winona & St. Paul, near Arcadia, Wis., engine of snowplow derailed and thrown down an embankment; engineer injured.

4th, on Pennsylvania, near Roaring Run, Pa., a passenger train was derailed by a mass of rock and earth which had fallen upon the track in a cut, wrecking engine and baggage car; 1 trainman injured.

6th, on Kansas City, St. Joseph & Council Bluffs, near Nebraska City, Neb., a freight train derailed by a tie which had been maliciously placed across the track.

7th, on Texas & Pacific, near Mesquite, Tex., a freight train ran over a cow and the engine and several cars were derailed and damaged; engineer and fireman injured.

8th, on Central Pacific, near Morley, Cal., passenger train ran into a large bowlder which had rolled down upon the track in a cut, derailing engine and 2 cars.

9th, on Central Pacific, near Wells, Nev., a freight train ran over a cow and was derailed; engineer killed and several other trainmen injured.

10th, on Philadelphia & Reading, near Reading, Pa., passenger train derailed by the wreck of a freight which had been thrown over from the adjoining track, damaging engine, tender and 1 car; engineer injured.

14th, on Boston & Albany, at Mittineague, Mass., snowplow pushed by 2 engines derailed by a frog clogged with snow and ice, and upset, partially demolishing an adjoining station building and platform; 1 employé injured.

14th, on Southern Pacific, near Colton, Cal., a freight train moving backwards ran over some cattle and the caboose and 13 cars were derailed and piled up in a bad wreck, which took fire from the caboose stove and burned up; 2 trainmen killed, two tramps stealing a ride injured. The freight intended passing an east-bound passenger train at the next stations, but failed to make time, and finding when midway between stations that it was running on the passenger train's time, proceeded to back down the grade to the last station.

15th, on Delaware, Lackawanna & Western, near Hackettstown, N. J., a snowplow forced into a heavy snowdrift by 4 engines collapsed, all the engines being thrown from the track into the ditch; 1 engineer killed.

15th, on New York & Northern, near Yorktown, N. Y., while 2 engines were pushing a snowplow through a deep drift the foremost one was derailed and its cab completely filled with snow, burying the engineer. The derailed engine broke loose from the other, ran some distance over the ties, and finally went over an embankment. Engineer and one other employé killed.

15th, on New York, New Haven & Hartford, near Berlin, Ct., passenger train derailed in a snowdrift.

15th, on Pennsylvania, in Philadelphia, Pa., a train of cars being violently pushed to get them out of a snowbank were derailed, one of them striking the iron supports of an overhead bridge. A large portion of the bridge fell, covering several main tracks, but on account of the deep snow no trains were running and traffic was not interfered with by the wreck.

15th, on West Shore, near Canajoharie, N. Y., engine of passenger train derailed by snow and ice.

16th, on New York Central & Hudson River, near Sharon, N. Y., a snowplow train, consisting of plow, 5 engines and 2 cabooses, charged at considerable speed a very deep snowdrift in a cut. The snow was very heavy and the engines were derailed, crushing into each other. Four trainmen were killed and 4 injured.

16th, on Central of New Jersey, near Annandale, N. J., passenger train derailed in a snowdrift on a curve; engine stightly damaged.

16th, on New York & New England, in Springfield, Mass., 2 engines of snowplow train derailed; 2 trainmen killed and 1 injured.

17th, on New York, New Haven & Hartford, near Farmington, Conn., snowplow train derailed.

17th, on New York, New Haven & Hartford, near Westfield, Mass., snowplow train derailed in a drift, injuring 4 trainmen.

18th, on New York, Philadelphia & Norfolk, near Nasawadox Station, Va., passenger train run into a tree which had fallen across the track, wrecking engine and 2 cars; 2 trainmen injured.

18th, on Union Pacific, near Mercer, Neb., freight train ran into a washout, throwing engine and 4 cars into the Platte River.

20th, on New York, New Haven & Hartford, near Conway Junction, Mass., passenger train derailed by a landslide.

20th, on Cadillac & Northwestern, near Mt Pleasant, Mich., engine of freight train derailed at a point where the roadbed had been impaired by heavy rains; engineer and fireman injured.

21st, on Rio Grande & Eagle Pass, near Laredo, Tex., coal train running with the engine at the rear was derailed by a large lump of coal falling off the front end of the foremost car.

21st, on Pennsylvania, near Green Spring, Pa., a coke train struck a boulder which had rolled down upon the track, and the entire train was thrown down an embankment into a river, making a very bad wreck; 1 trainman killed, 1 injured.

22d, on St. Louis, Iron Mountain & Southern, near Hilliard, Mo., a passenger train ran over a cow and the engine and tender were ditched and badly wrecked; engineer seriously and fireman slightly injured.

28th, on Oregon Railway & Navigation Co.'s road, near Arlington, Or., engine of passenger train derailed at a point where the track had been covered by drifting sand.

28th, on New York, Ontario & Western, near Sidney, N. Y., freight train derailed by a landslide and 2 engines and a portion of the train were piled up in a bad wreck.

30th, on Philadelphia, Wilmington & Baltimore, at Woodside, Del., freight train derailed and wrecked by a purposely misplaced switch. A tramp was arrested for forcing the switch lock and extinguishing the signal light.

29th, on Chicago, Milwaukee & St. Paul, in Chicago, Ill., a train of empty freight cars pushed by a C., B. & Q. engine derailed by the misplacing of a switch under the middle of the moving train. The switch was undoubtedly turned by striking brakemen or their friends.

The engine cut loose from the train and backed towards its home, but was soon derailed by a maliciously misplaced switch.

UNEXPLAINED.

1st, on Central Pacific, near Brentwood, Cal., 2 cars of a freight train derailed and ditched.

2d, on Brunswick & Western, near Sumner, Ga., freight train derailed.

3d, on New York, New Haven & Hartford, near New Haven, Conn., 2 cars of a freight train derailed.

4th, on St. Louis Bridge & Tunnel road in St. Louis, Mo., car of a freight train derailed.

6th, on Kanawha & Ohio, at Charleston, W. Va., passenger train derailed, engine badly damaged.

7th, on Central Pacific, near Otego, Nev., passenger train derailed.

7th, on Chicago, Milwaukee & St. Paul, at Middletown, Wis., 14 cars of a freight train were derailed and wrecked, killing a number of cattle.

7th, on Duluth, South Shore & Atlantic, near Marquette, Mich., 2 locomotives propelling a snowplow were derailed at a switch and crashed into some cars standing on an adjoining track, wrecking both engines and injuring an engineer.

9th, on Central Pacific, near Woodland, Cal., freight train derailed and 6 cars wrecked.

11th, on Philadelphia & Reading, at Ashland, Pa., freight train derailed and several cars wrecked.

11th, on New York, Lake Erie & Western, near Ridgewood, N. J., 3 locomotives pushing a snowplow were derailed in a snowdrift and badly damaged.

11, on Missouri Pacific, near Emory, Tex., several cars of a freight train derailed, killing a number of cattle.

11th, on Southern Pacific, near Santa Barbara, Cal., car of construction train derailed.

12th, on Pennsylvania, near Huntingdon, Pa., as a passenger and freight train were passing on adjoining tracks a car in the latter was derailed and thrown in front of the passenger engine, making a very bad wreck; 3 trainmen killed and 3 passengers injured.

12th, on Pennsylvania, in Philadelphia, Pa., locomotive derailed.

12th, on Pennsylvania, in Philadelphia, Pa., locomotive derailed.

13th, on Maine Central, at Ellsworth, Me., engine derailed and badly damaged.

13th, on Pennsylvania, near Jersey City, N. J., rear engine of a snowplow train derailed while running backward, injuring 3 trainmen.

13th, on Fort Worth & Denver City, near Rhome, Tex., 3 cars of a freight train derailed and damaged.

14th, on Camden & Atlantic, in Camden, N. J., an empty engine was derailed and ditched. It was immediately run into by three other engines, as will be seen by reference to the list of collisions.

15th, on Southern Pacific, at Powning Station, Cal., 6 cars of a freight train derailed.

16th, 2 a. m., on Delaware, Lackawanna & Western, near Vestal, N. Y., an east-bound passenger train running rapidly was derailed on a curve and all the cars tipped down an embankment. They took fire from the heaters and were consumed, but the uninjured passengers all escaped and succeeded in rescuing the others, of whom 3 passengers and 1 employé were killed and 6 passengers injured.

16th, on Norfolk & Western, near Eggleston, Va., engine and 12 cars of a freight train were derailed.

17th, on Savannah, Florida & Western, near Blackshear, Ga., the tender truck of a south bound passenger train, consisting of engine, baggage car, 2 passenger cars, a Pullman sleeper and a private car of President Wilbur, of the Lehigh Valley, was derailed just before reaching a long wooden trestle over Hurricane River. When the derailed truck neared the further abutment of the bridge it slewed around and tore up the sleepers, causing the structure to give way. The tender broke loose from the engine and, with the entire train, fell 20 ft. into the dry bed of the river, the cars falling one upon the other, making a complete wreck. Two trainmen and 25 passengers killed, and 5 trainmen and 30 passengers injured.

17th, on Seattle, Lake Shore & Eastern, near Seattle, W. T., engine of construction train derailed and damaged.

19th, on Richmond & Danville, near Toccoa, Ga., accommodation train derailed, damaging 2 passenger and 4 freight cars; 1 trainman and 1 passenger injured.

20th, on Fort Worth & Denver City, at Cheyenne, Tex., a freight train derailed and several cars wrecked; 1 trainman and a man in the caboose killed, 3 trainmen injured.

20th, on Northern Pacific, near Palouse Junction, W. T., freight train derailed and wrecked.

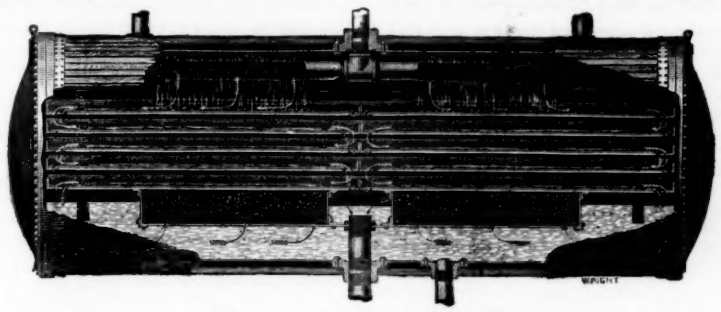
20th, on Southern Pacific, near Carlsbad, Cal., engine of freight train derailed.

21st, on Colorado Midland, near Ruedi, Col., engine and 5 cars of a freight train derailed and wrecked; fireman fatally injured.

23d, on Missouri Pacific, near Whitewright, Texas, 3 cars of a passenger train were derailed and damaged.

24th, on Chicago, Milwaukee & St. Paul, in Janesville, Wis., passenger train derailed, wrecking engine, tender and baggage car.

26th, on Illinois Central, near New Hartford, Ill., freight train derailed, wrecking 6 cars.



The Stillwell Live Steam Feed-Water Purifier.

26th, on Central Pacific, near Truckee, Cal., passenger train derailed in going on to a siding.

28th, on Northeastern, in Athens, Ga., engine of switching freight train derailed.

29th, on Burlington & Missouri River, in Lincoln, Neb., switching engine derailed and overturned.

OTHER ACCIDENTS.

1st, on Delaware & Hudson Canal Co.'s road, near Pleasant Valley, Pa., engine of a freight train exploded its boiler.

2d, on St. Paul, Minneapolis & Manitoba, near Fergus Falls, Minn., the smoke stack of an engine pushing a snow-plow was filled with snow while working in a deep drift, shutting off the draft and causing the flames to burst out through the door of the fire-box, fatally burning engineer and fireman.

8th, on New York, New Haven & Hartford, near Chester, Conn., engine of passenger train broke a parallel rod, one of the loose ends demolishing the cab.

9th, on Southern Pacific, near Tehachapi, Cal., tender of engine and 2 cars in a freight train when passing through tunnel No. 17 were buried by a fall of earth from the roof of the tunnel.

11th, on Louisville & Nashville, near Du Funiak, Fla., engine of passenger train disabled, having blown off its safety valve.

13th, on Southwestern, near Albany, Ga., steam-chest of locomotive of passenger train exploded.

24th, on Cleveland, Akron & Columbus, near Sunbury, O., engine of freight train broke both parallel rods.

28th, on New York & New England, near Manchester, Ct., engine of passenger train exploded its boiler, and was completely demolished, as were also the tender and forward end of baggage car, killing engineer and fireman. The engineer had just shut off steam.

The Stillwell Live Steam Feed-Water Purifier.

In many instances it is, for various reasons, impracticable to use an exhaust steam heater, and in other instances the impurities contained in the feed water are of such a nature as to require a much greater degree of heat to precipitate them than is possible to obtain with exhaust steam. The Stillwell live steam purifier herewith illustrated was designed to meet such requirements. It is a horizontal cylinder, made of best boiler steel plate, placed in any convenient locality above the boilers to be supplied, and with which it is directly connected. The cold water, or water from exhaust heater, is introduced at *A* through a pipe connected by tee with an horizontal pipe inside the shell. Both ends of this horizontal pipe are perforated with many small openings, through which the water escapes in the form of a shower. Live steam is admitted at *B B'*, filling the purifier with steam at boiler pressure. The water falls from the induction pipe through a body of steam into the top of two series of shallow iron pans, each pan being one-half the length of the purifier shell. These pans are provided with openings in the bottom at alternate ends, and the water is compelled to traverse their entire area in a thin sheet. As the heat and pressure in the purifier is the same as in the boilers, the water, in its passage over these pans, is subjected to the same chemical change as in ordinary boilers, and, it is claimed, is relieved of all scale-producing impurities, which are precipitated upon the surfaces of these pans, from which scale can be quickly and easily removed. After passing the circuit of the pans, the water drops into the large settling chamber *D D'*, in the bottom of the purifier, where the non-crystallizable impurities deposit in the form of slush or mud, and are blown off at frequent intervals through the blow-off *F*. To complete the work of purification, the water passes through the filtering chambers *E E'*, which are filled with coke or other suitable material, into the pure water chamber, then into the boiler through pipe *A'*.

It is claimed that the feed water is then absolutely pure, and at substantially the same temperature as the water in the boiler, thus effectually preventing the deposit of sediment in the boilers, and the strain upon the boiler incident to the introduction of water at a low temperature.

Each end of the purifier is provided with a heavy head fastened in place with cap screws. The depositing pans slide on ways which are fastened to the shell, and can easily be removed through either end of the shell for cleaning, and any impurities which may attach to the bottom of the purifier shell can readily be raked out, as removing the head exposes the entire inner structure.

The loss of fuel, leakage, and inconvenience caused by scale are well known, and this method of depositing and removing scale seems worthy of the attention of all steam users who have to contend with hard water. This apparatus is made by the Stilwell & Bierce Manufacturing Co., of Dayton, Ohio.

Brooklyn Bridge Terminals.

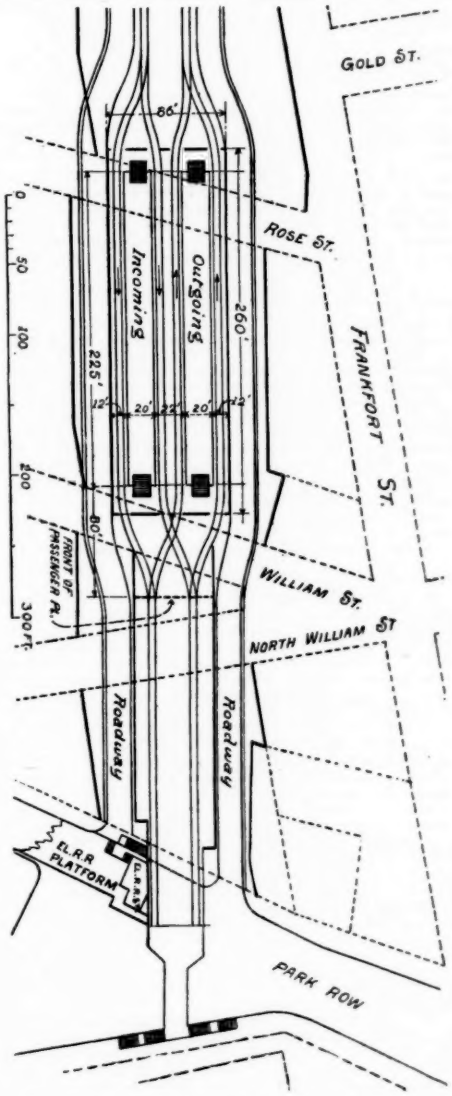
The following is the report of the Committee on Terminal Facilities made to the Board of Trustees of the Brooklyn Bridge:

The undersigned, on the 23d of February, received from the Board of Experts their report on the enlargement of traffic facilities at the New York terminus of the bridge. This report, which you have received, is a very careful and exhaustive one, worthy of the reputation of its authors, and one which clears the way toward arriving at definite conclusions.

The Board of Experts were not asked to estimate the cost of the improvements recommended by them, and immediately upon receiving their report the Chief Engineer, Mr. Martin, was instructed to make careful estimates of the cost of lands, buildings, new machinery and cars necessary to apply the circulating system as designed by A. M. Wellington, C. E., to both termini of the bridge. His report, just received, gives the cost as follows:

	New York terminus.	Brooklyn terminus.	Total.
Real estate for stations	$1,797,750	$456,500	$2,254,250
Real estate for store yards	....	448,000	448,000
Station buildings	1,100,000	1,100,000	2,200,000
New plant and machinery	.....	.....	475,000
100 new cars	.....	.....	400,000
Total			$5,777,250

This is a very large sum, and one which it might be wise to expend, so far as it would go, in providing new bridges or tunnels, rather than to expend it upon the present bridge.



Proposed New York Terminus, Brooklyn Bridge.

The attention of your Committee and that of the Chief Engineer was then directed to see how the present system can be enlarged. The Board of Experts, in their report (p. 10), say: "The maximum capacity of the bridge railway can only be attained by increasing the number of cars per train to the limit most desirable in actual service (which experience in operating them alone can demonstrate), and in fixing the headway intervals as short as absolute safety requires for handling trains of increasing lengths." This is very sound advice, and acting upon it, investigations have been made, which show that it is impracticable to run 18-car trains as proposed by Mr. Wellington. The Chief Engineer considers, and your Committee agree with him, that 4-car trains are about as long as can be safely and quickly handled.

This does not affect the adoption of the circulating system at all, for that is merely a method of avoiding switches and an adaptation to limited space. The space in Brooklyn is not limited, and there is no reason why the present rectangular system with tail switching, modified as suggested by the Chief Engineer, will not answer every purpose for the Brooklyn terminus for some years to come.

The same system can also be applied to the New York terminus, and no encroachment beyond the present lines of tracks upon Centre street, and no new lands will be needed. This modification of the present system is merely to add two more tracks parallel to the present ones, with intermediate platforms, all as shown in the accompanying drawings,* marked:

A, proposed New York terminus.

B, proposed Brooklyn terminus.

A double set of rails will be required on each track to avoid the use of switches for incoming trains, and leave the tracks unbroken. Under the present system the capacity of the bridge railway is limited by the time required to stop trains, unload them, switch them into place and reload them, which is 80 seconds.

But if two trains can be loaded and unloaded simultaneously, they can be dispatched in half the time now required, say 40 seconds, thus doubling the present capacity of the road.

The following table will show the increase:

Systems.	Intervals between trains, seconds.	Cars per train	Cars per hour.	Passengers carried per hour. Seated 42 in car.	Seated and standing 126 per car.
As now operated with 3 car trains	80	3	135	5,670	17,010
As now operated with 4 car train	80	4	180	7,560	22,680
Proposed plan—4 tracks and 4 cars	40	4	360	15,120	45,360

The cost of this improved system is estimated by the Chief Engineer as follows:

Rectangular system four tracks:

	N. Y. Station.	Brooklyn.	Total.
Real estate for stations	None.	None.	None.
Store yards for 75 cars	....	....	$168,000
Station buildings	$140,000	$120,000	260,000
75 new cars	.....	.....	300,000
New plant and machinery	.....	.....	45,000
Total			$773,000

Your committee have no doubt that this improved rectangular system is the one to be first carried out, and used until the traffic outgrows it.

There is nothing new or experimental about it. Its safety has been tested by over four years' experience and the conveyance of 90,000,000 passengers, in more than 700,000 trains, without accident to life or limb with the exception of the loss of a foot by a passenger in December, 1885.

It requires only slight alterations of the present machinery, and the alterations to the tracks, platforms and buildings can be carried out gradually and paid for out of the earnings of the bridge, as in the past. These changes will not interfere in the least with the traffic upon the bridge.

The safety appliances recommended by the Board of Experts can be equally well applied to this system as to the circulating system, should it be decided that they are needed.

So also a second set of overhead tracks to carry the trains of the Brooklyn elevated railways can be applied to one system as well as another if they are wanted.

It now only remains to consider what shall be done in the future, when this system is outgrown.

The number of passengers carried in 1887 by three-car trains in 80 seconds apart was 27,940,000. With the same average number of passengers per car the yearly number that can be carried will be about 75,000,000.

According to the estimate of the Board of Experts, this number will not be reached until 1895, or 7 years from now. Up to that time this proposed system will answer with an expenditure of $773,000.

It seems to your committee that it would be a more prudent and conservative course to put this system in operation and postpone the large expenditure until the traffic demands it.

In this age of inventions there is no knowing what the next 7 years may produce, and if the bridge trustees are not hampered by a present expenditure of nearly $6,000,000, they will be ready for the best thing that offers.

We now recommend that the President and Chief Engineer be instructed:

First—To put four-car trains in operation on the present system.

Second—To prepare for the doubling of this system as above described and shown in plans *A* and *B*, and put it in operation as soon as the needs of the traffic shall demand it.

And your Terminal Committee now ask to be discharged.

All of which is respectfully submitted.

T. C. CLARKE, C. E.
JAMES HOWELL, President.
BROOKLYN, April 17, 1888. Committee.

The Board of Experts mentioned in this report consisted of Walter Katté, Chief Engineer New York Central & Hudson River R. R., Col. Julius W. Adams, Past President Am. Soc. Civil Engineers, and Joseph Crawford, Supt. New York Division Pennsylvania R. R. The plan proposed by Mr. Wellington and recommended by this Board was to make the two bridge tracks continuous by a horseshoe curve of 90 ft. radius at each end. On this closed circuit of track seven trains were to be kept constantly circulating at a uniform speed of 10 miles an hour, the service to be varied by running a greater or less number of cars in the trains. The maximum number of cars per train proposed was 18. The cars were to be provided with side doors, one at the middle of each car on the inside of the curve, for loading, and one at each end of each car, on the outside of the curve, for unloading. These are the essential peculiarities of this plan.

A very important detail proposed was to so rearrange the grips that the cable could be dropped or picked up at any point on the route; to actuate all grips and brakes on any train by air, from one point, and to interlock them in such way that the grips must release before brakes are applied, and brakes must release before grips are applied. This, however, is in no way a necessary part of any plan, or restricted to either one of those proposed.

Another detail of Mr. Wellington's plan is described as follows:

It is also proposed, however, not from necessity, but for greater economy and convenience, to further facilitate the operation of these horseshoe curves by laying a broad outside rail having a trough or broad flat groove coated with a thick grease, and to provide the wheels on one side of each axle with a broad flat flange resembling a narrow duplicate tread, which rides in the bottom of this groove, and is of an outside diameter to correspond to the difference of radius of the outside and inside rail. This gives in effect an outside larger wheel used on the sharp curve only, which carries the main tread of the wheel on which the brake-shoes act, clear of the grease. The curve resistance, and extra rail wear as

* [Only the New York terminus is reproduced, that at the Brooklyn end being identical in principle.]

well, will be in this way almost entirely eliminated. What remains will be of no serious moment.

In the new arrangement of trains and terminals it was proposed to provide for the exit and entrance of passengers to and from the street in such way that the maximum walk would be as short as possible. It will be at once apparent that with circular platforms it would be practicable to place all the cars nearer to the street sidewalks than by any other plan. The final development of the proposed circulating system was to include one or perhaps two additional double tracks above the present tracks on which the cars of the Brooklyn elevated roads might run across to the New York terminus. This plan the Committee on Terminal Facilities have rejected for the reasons set forth in the above report.

In a report to the Chief Engineer of the bridge, Mr. G. Leverich, who has long been connected with the engineering department of the bridge railroad, estimates the engine power required to haul the seven 18-car trains uninterruptedly as 2,000 H. P., and that the cable should be 2¾ in. diameter. This would be about 3½ times as heavy and ⅛ as flexible as the one now in use. He says further:

It should be stated, that in computing the traction of trains as herein given, it was assumed that they were started and stopped on straight and level tracks; no effort being made to estimate the increase in traction due to the effort to haul the trains around the curve at the platform, and to start them from so unfavorable a stopping point: how great this increase would be from lack of similar or suggestive experience in the annals of railway management, it is difficult to judge. A qualified constructing engineer lays down curves of so short a radius rarely and always under constraint; a careful railway manager, when obliged to run trains regularly over them, unceasingly regrets the necessity, and by his rules for running and his vigilance, day by day, recognizes their danger, expense and effect on speed. If this be true of sharp railway curves over which trains are run, always with special care to prevent stopping, what shall be said of the attempt as proposed, to start and stop trains of 18 cars each on such a curve—if, indeed, it is possible to do so at all—not occasionally or at long intervals, but every 2½ minutes and at the rate of 466 cars per hour, laden possibly with 26,000 passengers? So far as known, the attempt is without direct or analogous precedent.

As to the practicability of running seven 18-car trains, he says, as heretofore stated, it is proposed to start and stop the 18-car trains in 10 seconds time or in running 73⅛ ft.

* * * for a run of 753⅛ ft. or for 51$\frac{4}{11}$ seconds, the incoming follows the outgoing train, each at full speed and loaded, around the curve of 90 ft. central radius, and with a space between the front of one train and the rear of the other of 260 ft., equivalent to 17$\frac{8}{11}$ seconds. Should the trains stop and start, each in 27$\frac{8}{11}$ seconds instead of 10 seconds as proposed, or in 203⅛ ft., they would similarly run around the platform, 30$\frac{7}{11}$ seconds or 493⅛ ft. in close contact. In preceding paragraphs discussing the haul of trains, the maximum traction at starting was excepted, for the reason that its magnitude varies inversely with the time spent in starting, and without doubt in practice this time will not be limited as proposed to 10 seconds; that it must be extended so that the traction at starting would be less than the maximum traction on the main line, is herein assumed. It is probable that instead of beginning to stop a train at a point 73⅛ ft. from its position at rest, the brakes will be applied when the head of train reaches the first part of the curve, or about 590 ft. from the stopping point, and that a train will not be started more rapidly. If so, allowing 20 seconds as the least headway between outgoing and incoming trains and 50 seconds as before for stopping at the platform, the consequent entire time for a round trip will be about 18 minutes 35 seconds, and but five instead of 7 trains, as proposed, will be in continuous service, with a headway on the main line of 3 minutes 43 seconds, whereby but five-eighths of so many cars as stated in the report could be run per hour.

How the railway is to be operated when the cable-driving machinery is in need of adjustment or repair, or how the trains are to be moved into the stations when the cable is temporarily stopped, is not indicated. In case of any interruption in the regular movement of trains the whole line will be blocked for an indefinite period; the 126 cars in continuous service occupying somewhat more than one half of the main track, and if close together will lap over the centres of the platforms, filling the entire space on one track between them. If the railway is to be regularly operated, the use of a large number of locomotives, heavy enough to haul the trains run, is unavoidable.

As the cars are designed, when trains are stopped elsewhere than at the platform and in line, the passengers being unable to move from one car to the other and thus pass to a point where perhaps they might reach the approach or footway, must remain caged up until the trains begin running.

Mr. C. C. Martin, Chief Engineer and Superintendent, has made a special report to the President of the Board of Trustees, from which some extracts are here given:

The trains [in the proposed circulating system] are designed to remain at the platform 50 seconds, and it is assumed that they can be started from a condition of rest and acquire the full speed of the cable, 10 miles per hour, in 10 seconds. Admitting for the sake of the argument that these things can be done in the time specified, there will be—according to Mr. Wellington's figures—a time in the station when the distance in the clear between the outgoing and incoming trains will be but 352 ft., and the time only 24 seconds* We then have this condition of things, namely, an 18-car train standing in the station on a curve of 90 ft. radius, fully loaded with passengers, and another train of 18 cars, also loaded, approaching the rear of the first train, on the same track, on a down grade of 170 ft. to the mile, at a speed of 10 miles per hour, with only 352 ft. intervening between the two. Should the outgoing train fail to start promptly on time, or fail to acquire speed with sufficient rapidity, or should the brakes on the incoming train fail to respond promptly and effectively, a collision would inevitably occur between the two trains of 18 cars each, both fully loaded with possibly 3,600 passengers. This in my judgment is a risk that should not be incurred. As you are well aware, under the present system, the trains receiving passengers are never in front of the incoming trains, but are on another track, and hence such a collision as indicated on the "horse-shoe" could not by any possibility occur. It may be said in reply to this criticism that a train can be easily stopped on a grade of 170 ft. per mile, from a speed of 10 miles per hour in a distance of 352 ft. So it can, when all of the conditions are favorable, but so long as materials, workmanship and mechanism may be imperfect and men may make mistakes, the possibility and danger of accident will ever be present in the proposed system.

Mr. Martin next points out that as regards switches, the circulating system cannot dispense with them any more than the proposed tail switching system. In the latter it is not necessary to run loaded trains against facing points, while with the circulating system that is, as we understand, necessary in one case, viz., the storage track switch at the Brooklyn end.

As an illustration of the inconvenience of operating the railroad by the proposed system, I would cite the case given in the report, page 20: "Should a car be disabled it is uncoupled from the rear cars, the head of the train grips the cable and pulls out a sufficient distance, and then the disabled car is dropped back by gravity onto the 'disabled car switch.' The head of the train then drops back by gravity and couples on to the rear of the train, and the whole train proceeds." Assuming that the disabled car can be as readily handled as before, not being derailed, and with its running gear in complete order, this seems very simple. How will it be in practice? We will also assume (for it has not yet been done) that a grip can be devised which can be made to drop and pick up a cable on a curve of 90 feet radius, as this is necessary in order to handle the train as proposed.

Supposing that the disabled car is in the middle of the train, then the half train with the disabled car attached would start out and go sufficiently far on the up grade to enable the disabled car to run back by gravity on to the "disabled car switch." The switch would then be thrown to the main track, and the train of 9 cars would drop back by gravity, half way around the curve, to be coupled to the portion of the train that had remained standing on the track.

* * If the operation was successful at the first attempt, every train on the road would have to come to a standstill before it could be accomplished, for this reason: It is assumed in the plan that the trains are to remain at the platforms 50 seconds for unloading and loading, and since the headway of trains is but 140 seconds, but 90 seconds remain in which to dispose of the disabled car, couple up the train and get it out of the way of the incoming train. It would be absurd to suppose that it could be done in that time. If not, then a blockade of the whole road would occur.

Now that the disabled car is disposed of, all of the trains standing, and the running of trains to be resumed, we have the following condition: There are seven trains of 18 cars each, or 126 cars on the road. Assume that two of the trains are on the curves at the stations, and the others at the rear of these, which is the position they would be in if they had moved forward as nearly as possible to their destination. More than one-half of the bridge tracks would be covered by cars; that is, 6,300 ft. out of a total track length of 12,520 ft. In starting the trains, it would be necessary to start two trains from each side, with less than two minutes interval between them; this would place the cable and machinery, on the up grade, four trains of 18 cars each, or 72 cars, weighing say 1,728 tons if loaded, as they would be, not only loaded, but packed, if there had been a delay of only a few minutes. This would bring enormous strains on the cable and machinery, much in excess of what could be safely permitted. By the present system, in case of blockades, short trains are started at such intervals as will not, as a rule, overburden the engines.

The report strongly recommends that all trains be equipped throughout with the Westinghouse continuous automatic train brakes, operated from a leading "cab," and which can be applied from every car in the train. The reason why this system is not adapted to the bridge service are twofold. We have no locomotives attached to the trains with which to compress the air required to operate the system. This would necessitate the erection of an extensive and expensive plant at the stations for compressing the air to be used. This air would necessarily be stored in reservoirs on the train, and to charge them would require so much time as to seriously interfere with the headway. This has been tried on the bridge, and with trains of 3 cars it was found to be impracticable. The system of brakes becomes inoperative if the pipes or reservoirs become leaky while the trains are on the road.

In my judgment the present system is much safer. This may sound strangely, but my reasons for the belief are the following: If the train hands—of which in the new system it is proposed to have but three, two in the "cab" and one at the rear—all be on the sharp lookout all of the time, the probabilities would be strong that if the air brakes did not fail there would be no collision; but should they fail there would be no reserve power anywhere to save the train. This is a risk which should not be incurred, as in an emergency, a collision would inevitably occur within about 20 seconds after it was found that the brakes were out of order.

In the present system, there is a conductor on each car, whose duty it is to open and shut the gates, look after the passengers on the train when required, and to apply and release both the grips and brakes on his car. As the train approaches the station he stands with his hand on the brake wheel, and within easy reach is the lever of the vacuum brake. Every man is at his post, and any one of the three can control a 3-car train, either with the hand or vacuum brake, or with both together; hence we now, really, have six means of controlling each train, with three men, each on the *qui vive* to do whatever the exigencies demand.

The fact that over 700,000 trains have been started and stopped twice without accident due to the failure of any part of the appliances, is to me good evidence that the precautions adopted have been well taken and are effective, and I should reluctantly exchange them for an appliance wherein a slight accident to men or machinery would endanger the lives of the train load of passengers.

The report recommends, "that an immediate modification be made of the present cable plant and grips, that will provide the ability in any case to slacken speed, release and again pick up the cable at any and all points of the passage over the railway." In my judgment this device would be entirely useless. With the present grip the speed of the cars can be slackened at pleasure, but when the cable is dropped it cannot be again picked up. If the train has passed the summit of the bridge and is on the down grade, there is no need to pick up the cable, for by simply releasing the brakes the train can easily and safely be taken into the station by gravity, as is done daily. If the train is on the up grade and is obliged to drop the cable and comes to a stop, it would not be safe to pick it up and apply the grip; for while the train is standing it is held by the brakes, and before the grips can be applied the brakes must be released; the instant this is done the train begins to move backward down the grade, and by the time the grip can be applied has acquired momentum which it would be unsafe to attempt to overcome by means of a cable running at the rate of 10 miles per hour in the opposite direction. Both the cable and machinery would be in danger.

Mr. Wellington has written a letter to the President of the Board of Trustees, protesting against the estimates used as the basis for recommendations for the Terminal Committee and for the action of the Board. He alleges that they are grossly exaggerated and misleading, in that they make the cost of his proposed system about $5,800,000, whereas he estimates that it would come below $2,000,000. He points out that the report of the Terminal Committee also omitted to mention that it is necessary to provide for only 8-car trains in order to equal the capacity of the system which has been adopted; that it omitted to mention the fact that operating economies in the system recommended by the Board of Experts will more than pay interest on the cost of carrying it out; and he requests that the plans adopted by the Board, and the statements and estimates on which the action of the Board was based, be referred to the Board of Experts, and to another, if it is desired, feeling satisfied that three disinterested experts in transportation and engineering cannot be found in America who will not sustain the statements contained in his letter.

* Mr. Leverich has shown that this space is 260 ft., and the time less than 18 seconds.

Steam Couplings—New York Railroad Club.

The regular monthly meeting of the New York Railroad Club, which was held April 19, was devoted to the discussion of the subject of couplers for steam heating systems.

Mr. MCELROY exhibited and described his coupler, which was shown in the *Railroad Gazette* of Jan. 20. As is well known, it has a straight opening of 1¼ in. diameter. The two halves are symmetrical, and he arranges it to unlock automatically by attaching wires to the locking levers so that the levers will be turned as the cars pull apart. Mr. McElroy claims that his coupler is steam tight with 120 lbs. pressure. The coupling crosses above the air hose. The size of the opening in the coupler is 1¼ in., while the train pipe is 1⅛ in., and by the increased velocity of the steam passing through the smaller opening Mr. McElroy claims to keep the coupler free from water of condensation. No traps are used.

Mr. CHASE, of the Williames system, exhibited his coupler, which is a modification of that shown in the *Railroad Gazette* of Dec. 2, 1887. This coupler has a straight opening, 2 in. diameter, and is steam tight under 120 lbs. pressure. The greatest sag is said to be between 8 and 9 in. It is so devised that the gaskets can be easily replaced with ordinary tools.

Mr. SEWALL exhibited his well-known coupler, which he says has been subjected to a pressure of 220 lbs. without causing it to leak, and couplers are now in use that have been running more than a year without a change of hose or gaskets. He said that they have been unable to get, on a continuous run of 1,000 miles, more than from 1 to 2 gills of water from the couplings. This coupling admits of a maximum opening of over 2 in.

Mr. GOLD exhibited his coupler with a trap lately devised, which is tight when the steam is on and opens when steam is shut off, and allows the water of condensation to escape. This is not the thermostatic trap which he formerly used, but a relief valve. This trap Mr. Gold is willing to apply to any other coupler than his own that may be preferred. The thermostatic trap had a hole of ⅛ in. diameter, which was found to be too small to afford relief before freezing at very low temperatures. The trap now offered will relieve the main supply pipe of all water in ¼ minute.

Mr. LOUGHRIDGE exhibited a form of coupler with metallic connections. The connections are of gas pipe, crossing diagonally between the cars.

Mr. S. H. BARRETT also exhibited a coupler, which he says had been used every day for a year under a pressure of 130 lbs., without renewal of gaskets. This coupler has been used the past winter on the Connecticut River Railroad. Steam at boiler pressure is used to heat the car quickly, and pressure is then put down to 8 or 10 lbs. There is no sag in this coupler.

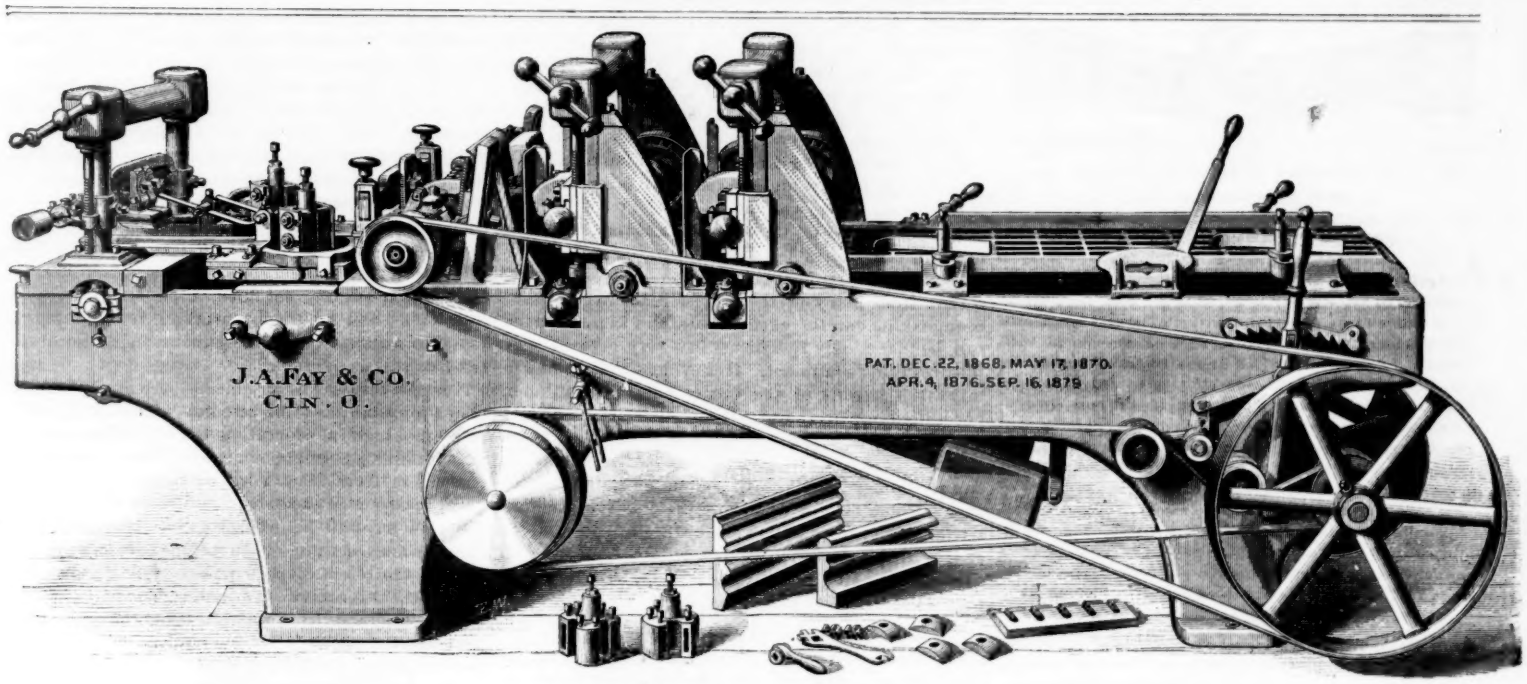
Mr. ALPHONSE COTE showed a model, which he described as an automatic steam metallic coupler. One half of the coupler is a piston with a spring disc inside the piston. The other part of the coupling is a bell, and when the two parts come together the piston fits into the bell. This has been in operation since the first of last December on the Staten Island Railroad. It has also been used on the New York Elevated.

Mr. GASSLER, who introduced himself as a Pennsylvania Dutchman, showed a model of a coupler which he claimed to be entirely automatic, shutting off steam when uncoupled. This has been tried on the Beach Creek Railroad.

Mr. STANLEY GOODWIN (Lehigh Valley) said that he had come to learn, and not to give information. He pointed out the importance of having a uniform coupler which could be used on all roads and, perhaps, with all systems of steam heating. If this can be devised and adopted it will be an exceedingly desirable thing. He said that his experience the past winter had taught him that the farther we get into the subject the more we see that there are things yet to be learned about it and that the whole matter of steam heating of cars is still imperfectly developed. Mr. Goodwin does not seem to think that the final coupler for universal adoption has yet been devised, but that it is very desirable that the energies and interests of the different coupler men should be directed in some common way. The result of the Lehigh Valley experiments is not by any means conclusive.

Mr. KINSEY, Master Mechanic of the Lehigh Valley, said that with 9 cars, from 75 to 100 lbs. pressure was required to get steam through the train; that is, if the steam is passed through each car separately; but if carried in a straight line through to the rear car, it can be done with 40 lbs. pressure. Not so much trouble was found on account of condensation as from friction in the long pipe. One and ¼-in. pipe was used.

Mr. BLACKALL, of the Delaware & Hudson Canal Co., requested that Mr. McElroy be asked to explain his system as used on that road. This system was described in the *Railroad Gazette*, Jan. 20, and an account of the trial trip on the Delaware & Hudson was given in our issue of April 6. It is not necessary, therefore, to reproduce here Mr. McElroy's description before the Club. He mentioned the fact



INSIDE MOLDING MACHINE (No. 2).

Made by J. A. FAY & CO., *Cincinnati, Ohio.*

that in using his system in connection with the Baker heater fresh water is used instead of salt, and he thought that railroad men were coming to consider fresh water preferable on account of the much more ready circulation, and Mr. Blackall added that the Grand Trunk, the Old Colony, the Boston & Albany and the Delaware & Hudson were all using fresh water for their Baker heater circulation. In speaking of a recent trial trip Mr. McElroy said that his experience has taught him that when he wants to fill the hot water apparatus the best way is to fill with water of condensation. "In that way we never fail to fill those pipes perfectly."

The topic of automatic draw-bars, which had been announced as the second topic of the evening, was put over as the subject for discussion at the May meeting.

In reply to a circular sent out with the call for the April meeting, asking certain questions as to experience with various systems of couplers, 18 roads replied as having equipped 640 cars. Of these, 14 were equipped with the Sewall, 2 the Martin, 1 Wilder, 1 Erie, 3 Gold, 2 McElroy, 3 New York Safety. Of the couplers, 16 were Sewall, 3 Gold, 2 each Martin and New York Safety, 1 each Wilder, McElroy, Coté and Westinghouse. Three answers were in favor of traps with the couplers; 17 were not. Seventeen favored hose connection; 3 did not. Four considered metallic couplers feasible; 14 did not. Sixteen thought it undesirable to delay the attempt to establish a uniform coupler; 4 thought longer delay desirable. In answer to the question what steam coupler is the safest to recommend at this time, 13 favored the Sewall, 1 each the Martin, McElroy, Gold and Coté, and 3 were not prepared to answer.

Inside Molding Machine.

The accompanying engraving represents a large inside molding machine, which has been designed to meet the wants of large establishments and of those where a machine of the heaviest character is needed for special and heavy work. This machine is made in two sizes, with one and two pairs of heavy feeding rolls. The frame is made with plate sides, and every part fitted in the most careful and substantial manner, adapting it to working house and picture frame molding, car and school furniture material; also for tonguing, grooving and beading flooring and ceiling. The capacity of the machine is to work from ⅝ in. to 12 in. in width, and to 5 in. in thickness.

The upper and under cylinders are made from wrought steel ingots, slotted on all four faces, and with chip-breaking lips for cross grained material. The shafts are of large diameter, and carry heavy flange pulleys; the upper arranged for two belts, the lower for one, both driving direct from the countershaft. They have an endwise adjustment across the machine, for securing a nice and accurate adjustment of cutters to the work, without disturbing them on the head after once being set. The side spindle frames are set, one in advance of the other, so the cut of one does not come directly opposite the other. They have heavy arbors and platens. The outside head carries a clip, and also board guides that extend to the under cylinder. The arbors and frames are adjusted laterally across the bed from one side to the other, by means of screws applied to each. When set in a desired position, by simply turning a hand wheel, they are securely locked.

All the bearings of the cutter head frame are exceptionally long and lined with the best lining material. The bearings of the upper cutter head are planed to fit to upright stands, which are cast solid to a bed, extending across the machine. The upright stands are fitted with a V, in which the bearings are bedded, whereby they are always retained in line, securing at all times a free access to the cutters to sharpen or reset. The lower cutter head is mounted in a heavy independent frame, and has also a vertical adjustment to suit the desired cut, also endwise adjustment for accuracy.

The pressure bar, before the cut, on the leading-in side, is mounted upon swinging arms, and so arranged that the edge of the bar can be brought close to the edge of the cutters. The pressure bar after the cut is made with sectional feet for clamping reverse pieces of the molding for holding down the work; it also has an adjustment to and from the cylinder to suit different diameters of cutters. The bed-plate is made with recesses to allow cutters to work below the line of the bed.

The patent beading attachment is used for beading narrow ceiling, and is mounted in the pressure bar over the under cylinder. By this arrangement the depth of the bead is always gauged from the surface of the board. It has a vertical adjustment with the bar, and the beads may be varied in width. It has sectional pressure clamping feet upon the front side of the bar for holding down the material and for receiving reverse pieces of the molding being worked. The entire end can be swung clear of the cylinder, securing free access to the cutters, for purposes of sharpening or adjustment.

The expansion feed works consist of four heavy feed rolls placed before the cut. They are expansively geared to suit the varying inequalities of work. These are mounted upon planed upright stands, fitted with ball and socket joints, and heavily weighted inside the frame. By a lever shown at the side of the machine the feed rolls can be instantly raised from the work for the purpose of withdrawing it or stopping the feed. It has also a self adjusting belt tightener for starting and stopping, and cone pulleys for changes of feed. Balance pulleys are applied to the cylinders for maintaining a uniform rotation, and to insure a smooth cut.

The machine is made by J. A. Fay & Co., 267 to 285 Front street, Cincinnati, O.

Train Speeds in Russia.

It is said by *Engineering* that the Russian Ministry of Railroads is now engaged in considering whether or not it is possible to increase the speed of mail trains in the Russian Empire. At present they run at an average speed of 20 miles an hour, including stoppages, and it is desired to increase this to an average of 23 miles. It is said that on some lines the speed of the mail trains does not average more than 16 miles an hour, and the ordinary passenger train does not exceed 12 miles, while on the best line in Russia, between St. Petersburg and Moscow, the ordinary passenger train speed is 15 miles an hour. The fastest train in Russia is the courier train between St. Petersburg and Moscow, which makes, including stops, 28 miles an hour. This train carries no mails and consists only of a few first-class carriages. Examples can be found on one or two branch lines of a train running at 10 miles an hour, and, even then, regularly arriving late. It is suggested that instead of trains of 20 carriages drawn by two locomotives running with the mails once a day on the main lines, it would be better to have two trains of 10 carriages each, running night and morning, but for the present the efforts of the Ministry are concentrated upon raising the speed of mail trains from 20 to 23 miles an hour.

Depreciated Values of Freight Cars.

In the offices of superintendents of machinery of most roads, the clerks in charge of settlements with other roads for cars destroyed have prepared tables, more or less elaborate, showing the depreciated values at the rate of 6 per cent. per annum, in order to save work, and to insure accuracy in each individual case. Mr. Barrow's elaborate table, giving these values for all kinds of cars of all ages have been described in these columns (Sept. 30, 1887), are printed and are kept for sale at the *Railroad Gazette* office.

An officer of the Michigan Central Railroad a year or so ago computed and distributed a small table of decimal multipliers to obtain the depreciated value at the end of each year, but it was incomplete in leaving the values at the end of any month to be computed.

Mr. La Rue Tiers, of the Allegheny Valley Railroad, has computed a small and convenient table for the same purpose, from which with but little arithmetic the depreciated value of any car, of any age, up to the point where the depreciation reaches 60 per cent. may be derived.

DEPRECIATED VALUE OF A CAR—ESTIMATED AT 6 PER CENT. PER ANNUM, AS PER M. C. B. RULES.

This table assumes the value of the car (or other property) to be $1,000; to obtain depreciated value of any other amount for same time, multiply by such amount and divide by 1,000.

Age.	Value.	Age.	Value.	Age.	Value.
		5 years.	$733.90	**10 years.**	$538.62
1 month.	$995.00	5 1/12 "	730.23	10 1/12 "	535.92
2 "	990.00	5 2/12 "	726.56	10 2/12 "	533 23
3 "	985.00	5 3/12 "	722 90	10 3/12 "	530.54
4 "	980.00	5 4/12 "	719 23	10 4/12 "	527.84
5 "	975 00	5 5/12 "	715.56	10 5/12 "	525.15
6 "	970 60	5 6/12 "	711 89	10 6/12 "	522.46
7 "	965.00	5 7/12 "	708.22	10 7/12 "	519.76
8 "	960.60	5 8/12 "	704.55	10 8/12 "	517.07
9 "	955.00	5 9/12 "	700 88	10 9/12 "	514.38
10 "	950.00	5 10/12 "	697.21	10 10/12 "	511.68
11 "	945 00	5 11/12 "	693.54	10 11/12 "	508.99
1 year.	940.00	**6 years.**	689.87	**11 years.**	506 80
1 1/12 "	935.30	6 1/12 "	686.42	11 1/12 "	503.77
1 2/12 "	930.60	6 2/12 "	682.97	11 2/12 "	501.24
1 3/12 "	925.90	6 3/12 "	679.52	11 3/12 "	498.70
1 4/12 "	921.20	6 4/12 "	676.07	11 4/12 "	496.17
1 5/12 "	916.50	6 5/12 "	672.62	11 5/12 "	493 64
1 6/12 "	911 80	6 6/12 "	669 17	11 6/12 "	491.11
1 7/12 "	907.10	6 7/12 "	665.72	11 7/12 "	488.58
1 8/12 "	902.40	6 8/12 "	662.27	11 8/12 "	486.05
1 9/12 "	897 70	6 9/12 "	658.83	11 9/12 "	483.51
1 10/12 "	893.00	6 10/12 "	655.38	11 10/12 "	480.98
1 11/12 "	888 30	6 11/12 "	651 93	11 11/12 "	478.45
2 years.	883 60	**7 years.**	648.48	**12 years.**	475.92
2 1/12 "	879 18	7 1/12 "	645 24	12 1/12 "	473.54
2 2/12 "	874.76	7 2/12 "	641.99	12 2/12 "	471.16
2 3/12 "	870.35	7 3/12 "	638.75	12 3/12 "	468 78
2 4/12 "	865 93	7 4/12 "	635.51	12 4/12 "	466.40
2 5/12 "	861.51	7 5/12 "	632.27	12 5/12 "	464.02
2 6/12 "	857.09	7 6/12 "	629.02	12 6/12 "	461.64
2 7/12 "	852 67	7 7/12 "	625.78	12 7/12 "	459 26
2 8/12 "	848.26	7 8/12 "	622 54	12 8/12 "	456 88
2 9/12 "	843.84	7 9/12 "	619 30	12 9/12 "	454 50
2 10/12 "	839.42	7 10/12 "	616.05	12 10/12 "	452.12
2 11/12 "	835.00	7 11/12 "	612.81	12 11/12 "	449.74
3 years.	830.58	**8 years.**	609 57	**13 years.**	447.37
3 1/12 "	826 43	8 1/12 "	606.52	13 1/12 "	445.13
3 2/12 "	822.28	8 2/12 "	603.47	13 2/12 "	442.89
3 3/12 "	818.13	8 3/12 "	600.43	13 3/12 "	440 65
3 4/12 "	813 97	8 4/12 "	597.38	13 4/12 "	438.42
3 5/12 "	809.82	8 5/12 "	594 33	13 5/12 "	436.18
3 6/12 "	805 67	8 6/12 "	591.28	13 6/12 "	433.94
3 7/12 "	801.51	8 7/12 "	588.23	13 7/12 "	431.71
3 8/12 "	797 36	8 8/12 "	585.19	13 8/12 "	429.47
3 9/12 "	793 21	8 9/12 "	582.14	13 9/12 "	427.23
3 10/12 "	789.05	8 10/12 "	579.09	13 10/12 "	425.00
3 11/12 "	784 90	8 11/12 "	576.04	13 11/12 "	422.76
4 years.	780.75	**9 years.**	572 99	**14 years.**	420 52
4 1/12 "	776.85	9 1/12 "	570.13	14 1/12 "	418.42
4 2/12 "	772.94	9 2/12 "	567 26	14 2/12 "	416.33
4 3/12 "	769.04	9 3/12 "	564 40	14 3/12 "	414.22
4 4/12 "	765.13	9 4/12 "	561.53	14 4/12 "	412.11
4 5/12 "	761.23	9 5/12 "	558.67	14 5/12 "	410 01
4 6/12 "	757.33	9 6/12 "	555.80	14 6/12 "	407.91
4 7/12 "	753 42	9 7/12 "	552 94	14 7/12 "	405.80
4 8/12 "	749.52	9 8/12 "	550.08	14 8/12 "	403.70
4 9/12 "	745.62	9 9/12 "	547 21	14 9/12 "	401.60
4 10/12 "	741.71	9 10/12 "	544.35	(40 per ct.	400.00)
4 11/12 "	737.81	9 11/12 "	541.48		

The use of the table and quickness of obtaining the result may be illustrated by an example: Required the present value of a 32-ft. 8-wheel box-car, 6 years and 5 months old. The M. C. B. settlement price, $275, multiplied by $672.62, and pointing off three places, gives $184.97. From Mr. Barrow's tables this figure can be obtained without any multiplication, but Mr. Tiers' table has the advantage of being small and compact enough to paste in a pocket memorandum book.

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

It seems probable that the M. C. B. type of coupler, the contour lines of which were published last week, will soon be very generally adopted. The Pennsylvania is applying a coupler of this type, the Janney, on stock cars, while the lines connecting with the New York Central, the Cleveland, Columbus, Cincinnati & Indianapolis; the West Shore and the New York, Chicago & St. Louis, and the New York Central itself are equipping a large number of freight cars with the Janney. As the New York Central and its allied lines have within the last few years used a large number of another type of automatic coupler, this willingness to join with other roads in using the M. C. B. coupler cannot be too highly commended, and it is to be hoped that the good example thus set will be followed by other roads which have hitherto adhered to couplers differing in principle from the M. C. B. type. It has often been pointed out in these columns that any great benefit from the use of automatic couplers can only be secured when their use is general, and that the best interests of all will be served by shortening the period of change from the present chaotic diversity to the general use of one type, inter-coupling automatically.

During the two months of last summer in which the letter ballot was taken for and against the Master Car-Builders' Association's recommendation of the Janney type of car coupler as a standard it was an open secret—well known to those directly interested—that much more than the slender margin of affirming ballots over the requisite two-thirds was secured through the efforts of Mr. McMunn and his associates in the Consolidated Coupling Company, and as a matter of history the fact may as well be recorded. It was done in two ways, one being what the politicians call "getting out the full vote"—always a difficult matter both in politics and in the association's ballots—and the other, inducing many railroad companies to join the association for the purpose of voting on this question. The result has been to strengthen the association numerically and financially, as well as to secure the adoption of a standard generally considered to be humane and economical. How far the later action of the Executive Committee will prevent litigation about the "lines" remains to be seen.

In preparation for the discussion of the question of steam-heating couplers, the New York Railroad Club sent out circulars to get expressions of opinion as to the use of flexible or metallic connection, the use of traps, the desirability of further delay for trials before adopting a uniform coupler, and as to the coupler now most preferred. The answers received were not numerous, but they may indicate the drift of opinion. Analysis of them shows that a flexible connection is recommended by officers representing roads operating about 5,800 miles, with 2,400 cars to be heated. Metallic connections are preferred by officers representing less than 100 cars and not much more than 100 miles. The replies which do not favor traps in the couplers represent about 1,200 cars (to be heated) and 3,200 miles of road. Delay was urged by the representatives of 400 cars and 1,800 miles, while officers of roads with 950 cars and 1,800 miles considered that further delay would be productive of harm rather than of good. There was but one coupler recommended by more than two or three of the answers, and that one had the favorable endorsement of officers representing 5,300 miles of road. Replies were not received from many of the largest roads which have been making careful experiments, and those received can be taken only to indicate in a very general way the prevailing sentiment. It is evident that having in mind the lessons of the car coupler, railroad men generally hope for the speedy adoption of a uniform coupler for steam heating; but it does not seem likely that the Master Car-Builders' Association would to-day recommend any known coupler as a standard, or that it would be wise to do so. Possibly the accumulated experience and knowledge will be sufficient to enable the Association at the summer meeting to narrow the matter down considerably, but more than that is hardly likely to be done.

The paper read by Mr. Frank Smith before the recent meeting of the Western Railway Club is a good example of the benefit derived from trying some experiments with the proportions of blast pipe and stack. The good results obtained by a single large nozzle and small stack have been often demonstrated, but this practice has not been generally followed, possibly because it requires some careful experiments to ascertain the correct form of the junction of the two exhaust pipes, so that the resultant single jet may be central and not strike the side of the stack.

Chairman Cooley has been in Chicago consulting with railroad men concerning the proposed law to punish freight shippers for giving false weights or descriptions. It appears that he favors including a provision requiring railroads to issue bills of lading on a more business-like basis, omitting such phrases as "more or less," etc.; in fact, guaranteeing the transportation and delivery of the goods in a more unqualified manner than at present. Most forms of bill of lading prepared by the railroads contain a number of more or less unfair provisions, and it would be well if the general subject were taken up by the Commission. Judge Cooley expressed himself quite freely on the question of dealing with Canadian competition, though the report of his remarks is somewhat confused. What he really did say apparently was that under the present law there is no way of preventing reckless competition by the Canadian Pacific for traffic between the Pacific Coast and Chicago or the Atlantic coast. He suggested that American roads might be prohibited from joining the Canadian Pacific in through rates on this traffic (which, of course, must be at a very low rate per mile) unless they would take other traffic at the same price, but he did not say that he was in favor of making a law to this effect. Such a law would probably compel roads situated like the Central Vermont to give up the through business, and if applied to Chicago-Boston traffic would considerably injure a road so situated.

The situation in the immigrant rate war changes rapidly from day to day. Last Saturday the Commissioners abolished the pool, and adopted the policy of making separate agreements with the different companies. Conferences for this purpose are now being held, and their results will probably be known by the time these lines reach our readers.

The Trunk Line Association has issued a statement complaining of the action of the Commissioners, and it seems to us that this complaint is to some extent well-founded. Four roads participated in the agreement of December, 1882; three others afterward joined them. By the terms of this agreement these roads had a practical monopoly of Castle Garden privileges and enjoyed a semi-official division of traffic. They stopped paying commissions and prevented, as far as possible, the sale of immigrant tickets outside of Castle Garden. For some time one of the seven companies has acted contrary to the terms of the agreement. Of late other roads, in self-defense, have followed suit. What the Association complains of is that the Commissioners, instead of exercising their power against the refractory road, remained quiet until there was a general fight, and then proceeded to abolish the agreement with all the roads indiscriminately.

We doubt whether any plan of separate agreements can be devised which will work as well as a joint agreement. The latter enables measures to be taken for joint handling of the traffic; the former means little more than the adoption of a common system—on paper. We all know how little such paper systems are worth. Each road can violate them at will, and does, without any very definite intention, violate them to some extent. The result is mutual suspicion and bad faith. When that condition of things is reached the agreements are not worth the paper on which they are written. If a plan can be devised which shall avoid these dangers we shall be glad, but we confess that we have not much hope of any such result. We shall be much surprised if anything is found to work so well as the joint arrangement of the last five years.

Not that this was by any means perfect. We are inclined to think that an attempt was made to keep rates too high in proportion to the facilities. Emigrant train loads can be made very large indeed; 300 passengers from New York to Chicago, at $13 per head, means over $2 per train mile both ways, even if the cars have to be returned entirely empty. Of course such a margin, or anything like it, vastly increases the temptation to irresponsible rate-cutting. To narrow this margin, either the rates must be lowered, or the facilities increased. We believe the latter to be much the more desirable result. We do not see how it can be attained under the system of separate agreements. The immigrant will appreciate cheapness more than anything else. Competition will be a competition in charges, not in attractions. But under a joint arrangement much might be done to improve the condition of immigrant traffic. Something was done; but, as far as we can judge from the meagre data at hand, the difference between train receipts and train expenses from this traffic would apparently have warranted a great deal more. The pool lines enjoyed a practical monopoly of the traffic, and had the assistance of public authorities in so doing. They were under a public obligation, morally, if not legally, not to use this monopoly as a means of extortion. If they have been violating the spirit of this obligation, as we suspect they have, they are now reaping the consequences.

The Brooklyn Bridge Railroad.

On another page will be found the report of the Brooklyn Bridge Terminal Committee with a sketch of the terminal arrangement recommended by that Committee and adopted by the Trustees. A very brief description of the system devised by Mr. Wellington is also given as well as some of the criticisms on it, and the substance of Mr. Wellington's letter to the Trustees protesting against their action.

The problem presented to the various individuals and bodies who have made, and passed on, plans for its solution is extremely complicated, and can be discussed with any intelligence only by those who have studied it carfully. Partly for this reason and largely for other reasons, the battle which has lately raged in the daily press has been unusually uninstructive. The efforts to make public opinion for or against the circulating system have been to a great degree inspired by considerations other than a regard for the public interest—considerations in which the various competitors and their plans have had no place.

The technical problem may be briefly stated. At present something over 30,000,000 passengers are carried a year, and the greatest number in the busiest hour of the day is about 10,000. Over 12,000 have been carried in one hour. Of these 10,000 passengers carried in one hour about nine-tenths are carried one way. This traffic is assumed to increase for the next four years by 15 per cent. per annum, and for the following six years by 10 per cent. per annum. It is quite possible that with better facilities the increase would be even faster. This estimated growth of traffic is not in controversy. Both parties agree essentially.

The capacity of the bridge railroad must be measured by the work to be done in the busiest hour. This is now to carry 10,000 passengers at least, and in 1895 over 25,000 an hour. This is on the two tracks. Assuming that nine-tenths of the traffic in this busiest hour is in one direction, the passengers to be carried on one track are 9,000 an hour now and 22,500 in 1895. The maximum capacity of the 3-car trains now run, giving them 80 seconds headway, is 5,670 passengers seated, or 17,040 seated and standing. That is, only from 52 to 63 per cent. of the passengers can be seated now in the hour of maximum travel, while in about four years, it would be impossible to carry all the passengers even with 67 per cent. of them standing, packed like sardines, in the aisles. The solution

of this difficulty which the Trustees now propose is a system of 4-car trains; seating 168 persons, running on 40 seconds headway. The seating capacity by this system is 15,120 per hour and will probably be reached in 1891. If, however, passengers are to stand as well as sit it is calculated that 45,360 can be carried.

The solution proposed by Mr. Wellington in his circulating system is to run trains on about 2½ minutes headway, with a sufficient number of cars in each to accommodate the traffic at any given hour, the cars to seat 56 persons. By this system 26,208 seated passengers can be carried per hour, which number may be reached about 1896. Shorter trains may be run at shorter intervals, and the seating capacity of the tail switching system, with 4-car trains, run on 40 seconds headway, will be equaled by the circulating system with 9-car trains, run on 2 minutes headway, or by even shorter trains run at less intervals. Obviously, therefore, it is unfair to compare the circulating system and 18-car trains with the rectangular system and 4-car trains as to operating expenses or cost of equipment and machinery. One is not the equivalent of the other in carrying capacity.

Further, the circulating system may be made more convenient at the termini, as with the curved platforms the exits from, and entrances to, all cars can be brought to within a somewhat uniform distance from the sidewalks, the loading and unloading may be more uniformly distributed along the platforms, and the passengers may be spared some walking. These are facts which should weigh in comparing the first cost of changing from the present system to either of those proposed.

Still another consideration is the time for which one or the other system will give sufficient carrying capacity. The Committee on Terminal Facilities estimated that the proposed rectangular system would be sufficient until 1895. The seating capacity will, however, be reached a good while before that time, that is, in 1891, and for four years a growing percentage of the passengers must stand during the three or four busiest hours. The seating capacity of the circulating system will not, at the same ratio of increase, be reached till about 1896, and of course the system can be made to answer for some years more by making passengers stand. We leave out of consideration the plan for adding two or four more tracks by double decking, as we suppose that the cost of that has not entered into the comparison made by the Terminal Committee, and as it is a resort open to the two systems.

In comparing the operating expenses of the two systems, as we have said, 9-car or 8-car trains on the circulating system should be compared with double 4-car trains on the rectangular. Mr. Wellington estimates a saving of $75,000 a year in switching service, and $53,400 in wages of train and platform men; in all $128,400. The item of switching service may be admitted, but while 126 men may be required to handle the 4-car trains, apparently more than 37 will be needed for the seven 8-car trains of the circulating system. Three men on each train would certainly be the least number permissible, and two men to each car would probably be required in each station, to open the doors on both sides, to attend to the ticket wickets and to keep passengers from approaching the dangerous gaps between the cars and platform on the curves. This accounts for 53 men instead of 37. The use of Westinghouse automatic brakes is an essential part of the scheme of running long trains with few hands, and some men must be employed at the stations to see that the reservoirs are charged. The expense of compressing the air also enters. The operating economy therefore is apparently not so great as is claimed. But there is a further consideration which we have not seen mentioned in this discussion and which may or may not have been taken into account by the Board of Trustees. The proposed combination of looped track, platforms and car doors which go to make up the circulating system, is patented, and a patent usually involves a royalty for the use of it. But a very moderate royalty on each fare would sweep away the whole saving in operation.

In comparing the outlay necessary to put in operation either of the proposed improvements it is fair to compare the rectangular with the circulating in its completest form, that is, with terminals, power and equipment for 18-car trains, because the greatest advantage of the circulating system is in that it will handle the traffic for a considerably longer time than the rectangular. This advantage can only be secured by the arrangement that will work the bridge to its fullest capacity. The rectangular system is confessedly only a makeshift for seven years. The circulating system must be much more than that to warrant the change. As to the comparative estimates of cost, however, we can express no opinion. An opinion, to have the slightest value, must be the result of serious and careful study. This first cost of the circulating system is estimated at $5,770,000 by one party, and at $1,888,000 by the other. The mean is $3,829,000, against some $800,000 for the rectangular system.

As regards safety there is probably little to choose between the systems. In the rectangular system no loaded trains need be run over a switch or crossing, and so far as we know none will be. In the circulating system loaded trains will necessarily run over two or three switches, but they can all be worked as trailing points, although it is proposed to run against the points of the storage switch. The length of the trains of the circulating system would cause some apprehension, especially if manned by but three men, and in these particulars must be considered at least as dangerous as the 4-car trains running as close as at 40-second intervals. There is no point in the latter system that offers the chances of derailment that would be had on the curves of the circulating system.

The practicability of working the 18-car trains as proposed, stopping and starting on semi-circles of 90 ft. radius, is, we judge, simply a question of power; but the apprehension expressed by the bridge engineers of serious delays to traffic seem well founded. It is too much to expect that a plan so new and untried should spring at once into being in full working order.

The case stands like this: The rectangular system will probably take care of the bridge traffic with comfort till 1891, and with more or less discomfort for three or four years more. The circulating system will do the work till 1896, seating all the passengers, and for a proportionately longer time if some of them stand. After the maximum capacity of either system is reached another bridge or a tunnel must be provided or the capacity of the present bridge must be increased by one or two sets of tracks above those now existing. The latter alternative is possible with the rectangular system as well as with the circulating.

There is still another matter which must have affected the decision of the Trustees. The large sum necessary to carry out the change to the circulating system could only be got by additional legislation, while the expansion of the present system will probably be provided for out of the earnings. In the first case the delay in increasing the capacity of the bridge railroad must have been much greater than by the method now proposed. It will be evident from what has been said that the decision of the Bridge Trustees was not without good and weighty reasons, and that it was not arrived at in wanton disregard of the obvious advantages of the plan which they rejected.

The Wear of Tires.

A correspondent, whose letter will be found on another page, asks how much the frictional resistance of an engine is increased by the unequal diameter of the driving tires, and cites a case of a ten-wheel engine, giving the diameters of the worn tires and other particulars. The question asked by our correspondent has long been a subject of argument, but as the amount of friction caused by driving wheels of unequal diameter is doubtless influenced by many variable factors, it is somewhat difficult to arrive at any very definite conclusion, and probably even experiments would show somewhat contradictory results.

In the case presented by our correspondent, we assume that the weight on the drivers is equally distributed, and that taking into account the extra load caused by the main rods, eccentrics, etc., the middle pair of drivers have 24,000 lbs. adhesion weight, and that the front and back pairs have 23,000 lbs. each, making in all 70,000 lbs. The third drivers are ¼ in. smaller than the main drivers, and the front drivers are ¼ in. larger than the main drivers. It may be convenient and reasonable to assume that these differences neutralize one another, that the main drivers roll truly, and that the front drivers slip in endeavoring to travel a greater distance than the main drivers, while the hind drivers slip in the opposite direction, and at each revolution tend to travel a smaller distance than the main drivers.

The slip of the front and hind drivers would be $\frac{1}{214}$ of their mean circumference, and the resistance offered, reckoning the coefficient of friction at ⅓, would be:

$$\frac{1 \times 1 \times 46{,}000}{214 \times 3} = 71.6 \text{ lbs.}$$

As the engine weighs 92,000 lbs., or 46 tons, it may be assumed that the engine and tender in working order will weigh at least 70 tons, and if our calculation is correct the extra resistance caused by the differing diameter of driving wheels is about 1 lb. per ton weight of the engine and tender.

Mr. D. K. Clark found many years ago that the frictional resistance of any engine and tender in steam might be taken at 12 lbs. per ton of 2,240 lbs. This equals 10.67 lbs. per ton of 2,000 lbs. consequently the equal diameter of the wheels in question would appear to increase the resistance of the engine and tender about 9 per cent. This is, however, based on the assumption that the co-officient of adhesion is as high as ¼, which is perhaps an extreme figure. With a lower co-efficient of adhesion, the increased resistance would not be as great under the conditions given by our correspondent. But in every-day practice cases are found where the diameter of wheels at the point bearing on the rails differs considerably more than ¼ in. Any engine having blind tires will soon develop considerable difference of diameter in the part of the tread bearing on the rail. If the line has few curves, the principal wear evidently takes place on the tangents and a groove little wider than the rail head is worn in the plain tires. Consequently when the engine is passing round curves the tires with flanges bear on the rail near the flanges where the tire is worn to the smallest diameter and the blind tires bear where they are comparatively unworn and consequently of maximum diameter. This difference in diameter may be often ¼ in. and the resistance may be relatively increased.

The increased resistance is not the only point to be taken into consideration in determining when driving tires require returning. A grooved tire is very destructive to frogs, the high part of the tire striking and wearing the frog, and the shock thus occasioned damages not only the frog but the engine.

It is probable that the wear of tires is almost wholly caused by their unequal diameter and insufficient width of bearing on the rail. These evils of course exist with freshly turned tires and new rails. The former are slightly taper and, therefore, unless the engine is exactly central and parallel with the track, even on a tangent, the diameters of the wheels at the points where they bear on the rails are unequal. The rails, on the other hand, are rolled with a radius on the top face, and are always somewhat bent and out of winding before they are put on the road, and this want of truth is increased by the unavoidably unequal support given by the ballast. The result is seen in the bright wavy line shown on new rails after the passage of a train. Considering tangents only, and omitting curves from consideration, some abrasion has evidently taken place, and it is equally evident that this abrasion would not have been possible had the treads of the tires been true cylinders rolling on true planes some 2 in. wide. Unfortunately it has so far been impossible to roll rails with a truly level top face, though in making recent rail sections the radius of the top has been increased.

It will generally be found, however, that rails are gradually worn to a larger radius in the top of the head, and that the surface thus produced has some relation to the coning of the wheels. Many attempts have been made to adopt cylindrical wheels and abolish coning over the greater part of the tread; but, while these attempts have been partially successful, the fact that a cylindrica tire will wear most near the flange, and consequently have a reverse cone, cannot be forgotten. In designing tire and rail sections it is not sufficient to design forms that will be best adapted for their purpose when new, but their suitability to resist wear and to wear well when half worn out must also be considered. This, of course, holds good of nearly every detail in mechanical engineering, but is especially necessary as regards rails and tires.

It is evident that the greater the slip of the tire on the rail, the greater the wear, and therefore badly and unequally worn tires not only somewhat increase the resistance of the locomotive, but the consequent slip and friction damages both rails and tires and accelerates the progress of wear. No very definite general rule can be laid down as to when tires should be returned, as the damage done depends more upon the unequal character of the wear than its amount. The cause, however, of unequal wear should be investigated and if possible prevented.

Per Diem Car Service.

Although the Time Convention has postponed official action on the car service reform, it does not follow that the movement should stop. The experience of those who are using "per diem" has already had

good results, and the officers in actual charge of car movement under the new system say that it is both practical and economical. The Pennsylvania, we understand, has determined to use it between the different roads of its own system, even if all others should abandon it. No definite reasons for delay were given at the Time Convention. Forty-five roads answered "Yes" to the Committee, and only 24 "No." Five said "not yet," and 5 "not ready."

When the number of cars affected by these replies is considered, the preponderance in favor of the new system is most significant. According to the lists published in the *Official Equipment Guide*, the roads now working under the per diem system control 309,123 cars: the additional roads signifying their readiness to adopt the system, as above referred to, control 63,500 cars. This number added to the first named gives a total of 372,623 cars, or nearly one-half the number of all the cars owned in the United States now in or ready to be placed in the per diem system. Against this only 81,292 cars are represented by the 24 roads answering "No," and which may be considered as opposed to the change. The ten roads answering "Not yet" own 39,981 cars, and it is fair to assume that at least half of this number would have adopted the system at once under the recommendation of the Convention. There were four roads, owning 35,904 cars, not included in any of the figures hereinbefore given, which signified their preference for a straight per diem system. We have, therefore, on this basis a showing of 428,517 cars, more than one-half of the total equipment owned in the country, favorable to the introduction of per diem car service.

Taking into consideration the small number of roads contributing this large number of cars to the per diem system as compared with the total number of roads in the country, it is fair to assume that the managers of roads owning large equipments which circulate freely over the country have strong faith that the reform will be productive of increased car movement and performance.

The objections of the short terminal roads are of course as weighty as ever. They fear that the balance against them will be greater than now. The case of the Chicago road which hauls to that city a large coal traffic in the cars of another company is typical. This road hauls the coal but a short distance and receives but a small portion of the rate, which is low, while the other owns the cars, hauls the freight over a much longer mileage and gets a larger revenue. The terminal road says, and doubtless with truth, that if it were to pay 15 cents a day for the cars during their stay in Chicago, it would be paying out more than the profit on the transportation of the coal, and lose money, notwithstanding the lower rate of mileage on the cars. In an imaginary case of a car of coal weighing 15 tons transported 100 miles, 90 over the initial line and 10 over the terminal, for $15, the cost of terminal switching on such a car ($1.50) would absorb *all* the revenue of the shorter road, while it would take only 11 per cent. of that of the longer. But this simply shows that the revenue is not equitably divided between the roads. When, a few years hence, American roads find themselves in the position of the English, whose terminal yards, buildings and appliances are so costly as to impose $1 per ton on every load of freight passing through them, they will have to radically readjust proportions of through rates. This indeed has been done here already in the case of grain delivered at New York, and in lesser degree elsewhere. The cost of detaining cars, which always existed, but is now set forth in a stronger light, simply adds one more reason for making a change in the manner of reckoning. If, in our supposed case, the 90-mile road owns the cars, it may be said that it receives its pay for their detention in the shape of unequal profit on the carriage of the coal, which is in a degree true; but it needs no argument to show that there is no assurance of fairness in such a method, and a rule for universal use must assume that the ownership of cars is not so clearly defined. Nearly every kind of traffic uses the cars of a number of owners and in varying proportions. A car standing on a side track, either loaded or empty, is a burden of expense to some one. This some one should be the party which has the power to stop the expense, and that is the road owning (or "operating") the track. If the shipper or consignee, instead of the road itself, causes the delay, *that* road and not the one owning the car is the one to transfer the pressure to the customer.

It is to be hoped that a few at least of the managers of the smaller roads will have the courage to make a trial of the new system, and thus have the honor of being pioneers for the others to follow. Although railroad managers, like other people, are not free from selfish motives, there would seem to be no special reason to fear that those of the longer roads would not acquiesce in a reasonable proposal for a readjustment of through rates to offset any hardship imposed by the change in car service expenses. The car accountants say that the increased movement of cars—which means saving of time and so of capital invested—is already large enough to be seen with the naked eye and to be ascertainable definitely with a slate and pencil. One large road is said to have made other use of several hundred thousand dollars which had been intended to go for new freight cars.

The Iowa Railroad Law.

We publish in another column an abstract of the new railroad law of Iowa. A large part of it is simply a restatement of the principles of the Interstate Commerce Act, in such form as to make them applicable within the state of Iowa. With this no fault can be found. But there is another series of provisions, with reference to the authority of the Commissioners in fixing schedules of rates, which is really dangerous.

The evil lies not so much in the substance of the law as in the manner in which it is likely to be applied. There are other states where the Commissioners have power to make out freight schedules, and where the existence of this power has done no harm. All depends upon the form in which it is exercised. If an impartial body, in arranging a classification, should really do what the Iowa law requires, and see that all interests, *including those of the railroads*, were given a full hearing, the result would be a good one. It would simply carry out the idea suggested in these columns two weeks ago, that there should be an organized effort for interchange of views between shippers and railroad officials, and that rates should be arranged as an outcome of such conferences.

Unfortunately it is not at all likely that anything of this kind will happen in Iowa. It would be too good to expect in any event, however well the laws were arranged; and there are two provisions in the Iowa law which put such a result out of the question. In the first place, the Commissioners' action is not to any great extent subject to revision by the courts; and in the second place, they are elected by the people instead of being appointed by the executive.

If we compare the present Iowa law with the Illinois law of 1873, which has served as a model for many other states, we find that in Iowa it *is* unlawful to exceed the commissioners' schedule; while in Illinois it is simply *prima facie* evidence of unlawful conduct, which the railroads may rebut by introducing other evidence before the Court. The Illinois commissioners have a great power; but not an irresponsible one, such as it is proposed to give in Iowa. That the power of the commissioners in Iowa will be thus irresponsible seems to be pretty clearly indicated by the drift of events in Minnesota under a somewhat similar act of 1887.

Where there is an irresponsible authority of this kind, it is of the greatest importance that it should be impartial. This result is precisely what the Iowa law does not secure. An act has been passed this year under which the Commissioners are to be elected by the people. This is by far the worst feature in the whole legislation. It is simply putting pressure to bear on the Commission to decide unfairly the matters which come before it. There are four hundred thousand voters in the state of Iowa; there are not a thousand persons in the state who hold railroad stock. By deciding a doubtful point in favor of the Iowa shipper, there are four hundred votes to be gained for one to be lost. This is no mere fancy; it is a real danger. The Iowa railroads are largely owned outside of the state. In 1886 only one stockholder in forty-three lived in Iowa, and the capital owned within the state was only one seventy-third part of the whole. Under such circumstances the average voter feels that he, as a citizen of Iowa, has an interest in reductions of rates. He is prepared to vote for a commissioner who will favor such reductions, and against one who decides against them, no matter how good the ground for such decisions. Nor is the local railroad interest strong enough to make itself felt as a counterpoise.

One instance of this will suffice. In the year 1871 the Illinois legislature passed an act regulating railroad rates, which was clearly and distinctly unconstitutional. The state courts pronounced it such, not touching upon the merits of the question, but simply dealing with matters of legal principle. Yet the judge who rendered this opinion—a man of pre-eminent ability and character—was defeated at the next election by a man vastly his inferior in every respect. There were no charges made against the integrity of the previous incumbent, nor was any serious attempt made to impugn the grounds of his decision. The election was simply a notice that no judges were wanted who would decide points in favor of the railroad.

We were present at a mock trial not long ago, in which the jury, after retiring, sent back to the judge for additional instructions. The question was: "What sort of use are we to make of the circumstantial evidence?"—most of which had been very irrelevant. And the judge replied: "You are to use it *against the prisoner*." We fear that under an elective commission this will be the general rule of evidence in Iowa.

March Accidents.

Our record of train accidents in March, given in this number, includes 65 collisions, 99 derailments and 8 other accidents; a total of 172 accidents, in which 85 persons were killed and 211 injured.

These accidents are classified as follows:

COLLISIONS:		
Rear	36	
Butting	26	
Crossing	3	
		— 65
DERAILMENTS:		
Broken rail	7	
Loose or spread rail	1	
Broken bridge	3	
Broken frog	1	
Low joint	1	
Broken wheel	2	
Broken axle	6	
Broken truck	2	
Failing of brake beam	1	
Misplaced switch	4	
Lurching of load	1	
Runaway train	2	
Bad switching	1	
Cattle on track	4	
Snow and ice	12	
Washout	2	
Landslide	5	
Sand blown on track	1	
Accidental obstruction	3	
Malicious obstruction	1	
Purposely misplaced switch	3	
Unexplained	36	
		— 99
OTHER ACCIDENTS:		
Boiler explosion	2	
Broken parallel rod	2	
Miscellaneous	4	
		— 8
Total number of accidents		172

The causes of collisions where given were as follows:

	Rear.	Butting.	Crossing.	Total.
Trains breaking in two	5	..	..	5
Misplaced switch	4	2	..	6
Failure to give or observe signal	6	..	3	9
Mistake in giving or understanding orders	..	4	..	4
Miscellaneous	8	3	..	11
Unexplained	13	17	..	30
Total	36	26	3	65

A general classification shows:

	Collisions.	Derailments.	Other.	Total.	P. c.
Defects of road	..	13	..	13	8
Defects of equipment	..	11	6	17	10
Negligence in operating	34	7	..	41	24
Unforeseen obstructions	..	28	..	28	16
Malicious	1	4	..	5	3
Miscellaneous	..	..	2	2	..
Unexplained	30	36	..	66	39
Total	65	99	8	172	100

The number of trains involved is as follows:

	Collisions.	Derailments.	Other.	Total.	P. c.
Passenger	43	28	4	75	33
Freight and other	83	73	4	160	67
Total	126	101	8	235	100

The casualties may be divided as follows:

KILLED:	Collisions.	Derailments.	Other.	Total.	P. c.
Employés	15	34	4	53	62
Passengers	..	30	..	30	35
Others	..	2	..	2	3
Total	15	66	4	85	100
INJURED:					
Employés	41	62	..	103	49
Passengers	24	78	..	102	48
Others	1	5	..	6	3
Total	66	145	..	211	100

Thirty-three accidents caused the death of one or more persons, and 34 caused injury but not death, leaving 105 (61 per cent. of the whole) which caused no personal injury worthy of record.

The comparison with March, 1887, shows:

	1888.	1887.
Rear collisions	36	20
Butting "	26	22
Crossing "	3	3
Derailments	99	59
Other accidents	8	13
Total "	172	117
Employés killed	53	32
Others "	32	27
Employés injured	103	68
Others "	108	144
Pass. trains involved	75	46
Average per day:		
Accidents	5.55	3.77
Killed	2.74	1 90
Injured	6.79	6.84
Average per accident:		
Killed	0.500	0 504
Injured	1.227	1.8.2

The marked features of the month were the Blackbear disaster and the great storm in the eastern and middle states, which have been referred to in previous issues. While, no doubt, many derailments in the snow-storm were never reported in the papers, it is, on the other hand, doubtless fair to assume that many of them, which perhaps caused much annoyance and long delay, were not really accidents in the sense of involving risk to life or limb, or even property

to any great extent. Many drifts were no doubt "reduced" by pushing an engine into them when it was well known that the chances of running off the track were quite good. In the absence of shovelers this might be the most sensible course if the speed were not too high.

February had as many accidents as March, but the number of persons killed in the latter month jumped 100 per cent. without counting the victims at Blackshear. The comparison with a year ago continues as bad as it has been generally for several months past, the number killed, leaving out Forest Hills last year and Blackshear this, being 66 per cent. greater now. One of the worst accidents in the present report is of a sort which must grow more common until the number of poor wheels and axles in use is reduced, to wit, the wrecking of a passenger train by the derailment of a freight on an adjoining main track at the moment the passenger is passing at high speed. This accident (on the 12th) was on one of the best roads, as was the similar one which killed eight persons last year. Cases of this kind forcibly show the need of good wheels and axles under freight as well as passenger cars. The causes of the derailments in snow-drifts are often given carelessly or incorrectly no doubt. The accident at Hondo, Tex., on the 1st is classed as from "defect of road," though the account indicates that the defect would have caused no accident except for a conductor's negligence.

Oregon enjoys the distinction of furnishing two of the most unusual accidents of the month. In one case a number of passengers were tipped off an 18-ft. trestle, because some cattle objected to paying the porter's fee or for some other reason refused to stay in the berths assigned to them. In the other a wind-storm covered the track with sand, and derailed a train. Narrow gauge roads will have to employ an experienced sailor to stow their loads if they insist on running such wide car-bodies. Live stock will have to be packed in saw-dust. The Oregon bovines ought to have taken lessons on the narrow gauge road in Pennsylvania which carries, or did carry, loaded standard gauge cars, trucks and all, perched up on its own platform cars.

A tragic episode of northwestern railroad life in winter appears in the killing of two men by snow clogging the smoke stack. In the sleeping cars which went down a bank at Vestal, N. Y., it is said two men remained asleep in their berths. At Elmira, N. Y., March 5, the engineer and fireman of an east-bound passenger train on the Erie very badly injured themselves by jumping from their engine in the night to escape a collision which did not occur. They saw the red lights of a freight ahead and set the air brakes, but the engine did not collide with the caboose (or barely touched it), and the passenger train men had to study a little to find what had become of their runner.

The Grand Trunk had a butting collision of passenger trains, injuring a dozen passengers, and a Mexican construction train ran off, killing six.

The following ordinance of the Russian Minister of Public Works is not without interest:

"In connection with the loading and transportation of live stock by rail, complaints have been made that the station authorities do not give proper care to the actual shipment, nor to switching and making up trains at intermediate points—all this being left in the charge of subordinates without proper oversight. The consequence is said to be that careful treatment of the shipments can only be obtained by paying fees; and that the same course is sometimes necessary in order to make sure that the cattle shall be properly watered at the places arranged for that purpose. I call attention to the regulations of Jan. 15, 1876, for state railroad officials, as well as to the other edicts against receiving fees, and I expect that vigorous measures will be taken against such violations of duty on the part of state officials and laborers."

This is chiefly important as illustrating the tone which prevails with regard to certain questionable practices among foreign railroad employés. The advocates of a state railroad system claim, as perhaps its chief advantage, that the standard of conduct among its employés is higher than it otherwise would be. Facts like this cast a curious side-light upon such claims. Here is a practice which involves moral wrong, which brings not only injustice to some of the shippers, but personal degradation to the railroad official who lends himself to it, a practice distinctly forbidden by repeated enactments. And yet these same state railroad officials, who are set up on a pedestal for us to admire, are found systematically evading the enactments and practicing the wrong. We say "systematically" for this cattle instance is but one among many. The man who attempts to make long night journeys will receive strong hints that a bribe will be acceptable. We do not say that all European trainmen give such hints, but we have yet to see the state railroad conductor who had self-respect enough to refuse a quarter when it was offered.

These are little things; but their very littleness makes them in one sense all the more degrading. We know of too many officials in this country who will take a drink with a customer; but we are happy to say that we do not believe there are many who would take a dollar to influence them to do their work unfairly. Porters receive fees for special services; but those officials who do general and not special service ought not to accept anything of the kind. If such a man takes a fee and does not let it influence his conduct, he has been obtaining money on false pretenses. If he does let it influence his conduct, he does a public wrong.

The German railroad authorities are a little inclined to be Pharisees. When they look at the United States they feel their moral sense outraged, and "thank God that they are not as other men are, extortioners, unjust, or even as this Republican." We therefore take pleasure in calling their attention to a "beam which is in their own eye." Not but what we have beams enough in ours; but in a discussion of this kind the publican has an advantage over the Pharisee, in that he never claimed to be holier than other men, and can therefore treat the argument of "you're another" with lofty scorn.

Chicago dispatches of April 19 state that Commissioner Cooley has promised the Burlington engineers to have their strike investigated by the Inter-state Commission some time in May. This is, we believe, the first matter of any kind outside of strictly traffic questions that the Commission has given any attention to except in connection with the proposed form for annual reports. A report by an impartial tribunal of this kind is much to be desired, as the road, with its feeling of strength engendered by the conviction that its rates of pay were reasonably high, and the men, in their confidence that they could beat the road without the aid of public sympathy, have both failed to publish a full and fair statement.

A Pittsburgh paper of recent date quotes a letter from an engineer who went from there to the Burlington road. He says that he receives $4 per day, work or play, and at present gets his board and washing free. Those who wish to go East for their families are offered transportation both ways. A dispatch from Lincoln, Neb., says that the medical officer of the Burlington road finds the injuries received by employés very light for the past two months. This he attributes to the fact that the new men are particularly anxious to make good records, and, working with strangers, are more than ordinarily careful.

The Kansas City switchmen of the Hannibal & St. Joseph, who struck last week because one of their number was discharged for knocking down the yardmaster, have returned to work, the dispute having been compromised.

The cessation of strife in the Northwest promises to last only about one month, the Chicago, Burlington & Northern having already notified Chairman Faithorn that it is not satisfied with its share of the business, and will make a reduction in freight rates May 1. General Manager Harris says that he must make rates between St. Paul and the Atlantic Seaboard on the same basis, as compared with the water lines, that is used between Chicago and New York. This would make the through rate (first-class) $1.01. The Chicago-New York rail rate is 75c., lake and rail 54c., difference 21c. First-class through via Duluth is 80c., which increased by 21c. makes $1.01. This is about 25 per cent. below the regular rates, and it is said that the older lines between Chicago and St. Paul show some disposition to ignore the cut and maintain full rates. The trunk lines have thus far preserved a pretty solid front against the demand that they pro-rate with Northwestern roads, and unless they change, as there is no present prospect of their doing, the loss will fall wholly west of Chicago.

The Supreme Court of Minnesota has decided in favor of the State Railroad Commissioners in their suit to compel the Chicago, Milwaukee & St. Paul to accept and use the tariff prepared by the board for the transportation of milk. The decision says: "The determination of the Railroad and Warehouse Commission as to what are equal and reasonable fares and rates for the transportation of persons and property is conclusive, and in proceeding by mandamus to compel compliance with the tariff of rates recommended and published by them no issue can be raised or inquiry had on that question. The authority thus given to the commission to determine in the exercise of their discretion and judgment what are equal and reasonable rates is not a delegation of legislative power."

The Boston & Albany has just finished a short iron bridge, 38 ft. long, riveted lattice pony truss, which displaces the last wooden Howe truss bridge on the main line of that road. The main line of the road is now completely equipped with iron and stone bridges, with the exception of a short trestle bridge at Natick, which will probably be left on account of the foundation.

The Baltimore & Ohio has within the last year built many new bridges, replacing the Fink and Bollman trusses. The most notable of those completed early this year was the Tray Run bridge, crossing a mountain gorge 2 miles west of Rowellsburg Station. It is a double track deck structure of 6 spans, 2 girders of 45 ft. each, and 4 truss spans varying from 72 to 155 ft. The greatest height from the bottom of the gorge to the base of the rail is 150 ft. This structure takes the place of the famous cast-iron viaduct designed by Albert Fink and erected some 30 years ago.

It is understood that the Swinnerton locomotive has not proved particularly successful, and that it has been withdrawn from active service in order that alterations may be made. The peculiar feature of the engine was the form of the driving-wheel tires, which were polygonal rather than truly circular. No less than 210 flats were milled across the tread of each driving tire. Another inventor has gone still further in this direction, and the last *Patent Office Official Gazette* contains a patent for making shallow recesses or cavities in the treads of tires. The inventor, however, omits to state whether the extra adhesion is secured by filling these recesses with mucilage or with birdlime. Possibly a mixture of both, with a little soft soap for Sundays, would be found to give the highest co-efficient, and cause the train to lose most time.

Iowa Railroad Legislation.

The most important laws relating to railroads which have passed the 22d General Assembly of Iowa are those relating to the manner of electing railroad commissioners, and the general law regulating railroad traffic and defining the duties of the commissioners in relation thereto. Two important bills, one for the reduction of passenger fares on first-class roads to two cents and the other for a new freight tariff, did not pass. The former went through the House but remained in the Senate at the time of adjournment. The latter did not pass the House committee. The bill relating to the office of railroad commissioners provides that the office shall be an elective one instead of being filled by the Governor.

The outlines of the general traffic regulation bill we give below. It is entitled: "An Act to regulate railroad corporations and to increase the powers and further define the duties of the Board of Railroad Commissioners in relation to the same, and to prevent and punish discrimination in the rates charged for the transportation of passengers and freights on railroads in this state, and to prescribe a mode o procedure and rules of evidence in relation thereto." Also it repeals certain acts defining the power of the Commission.

Section 1 defines the word "railroad" and states that the provisions of the act shall apply to all transportation of passengers and property with the storage and handling of the same by railroads, express, sleeping car or freight line companies. This regulation is intended to cover any shipment when the terminal points are in the state, even though in transit it may have passed through other states.

Sec. 2. All charges shall be reasonable and just.

Sec. 3 prohibits all rebates or drawbacks which are not given to all alike, but specifically allows a lower rate by carloads than on broken lots.

Sec. 4. No preference in handling or shipping traffic shall be given particular individuals or firms, except that in transit live stock or perishable freights may have the preference in promptness of transportation.

Sec. 5. No road shall charge more for transportation for a shorter than a longer distance, the shorter being contained in the longer, or more than a fair or just price on one part of its line as compared with charges on another portion.

Sec. 6 prohibits pooling, making each day of the existence of such unlawful device a separate offence.

Sec. 7. All schedules of rates both freight and passenger shall be posted, with full explanations, in each freight office and passenger station. No increase in rates shall be made without 10 days notice giving the nature of such increases. Reductions may be made without notice, but shall immediately be posted. Copies of all rates to be filed with the commission as also copies of joint tariffs with other roads. Neglect to file shall be punished, and there is provision for obtaining such punishment where the road is a corporation foreign to the state.

Sec. 8 forbids any combination or arrangement by which freights are prevented from being considered as one continuous shipment, or any break in carriage with intent of evading this act.

Sec. 9 provides that for any violation of the act by which any person suffers loss the roads shall be liable to such person to three times the amount of damages sustained in consequence of any such violation, with all costs for suits relating to the same.

Sec. 10. That any persons claiming damages under the act may make complaint to the Commissioners or bring suit in any court in the state, but no persons can pursue both remedies at once. Any evidence or witnesses necessary may be summoned before such a court.

Sec. 11. Any officer or employé who shall evade or disobey the provisions of the act shall be considered liable to punishment for misdemeanor.

Sec. 12. It shall be the duty of the Railroad Commission to inquire into the management of the business of common carriers, and they shall have the right to call upon the roads for such information as they deem necessary to this end, either through the appearance of persons or the production of books and records.

Sec. 13. That any person or firm having a complaint against a common carrier shall present the same in writing to the Commission, and the Commission shall forward a statement of such complaint to the common carrier, requesting a reply within a reasonable time. If the matter complained of is not remedied in such notice, it is the duty of the Commission to make full inquiry into the same.

Sec. 14. In case of an investigation, the Commission shall make a report in writing in relation thereto, giving the finding reached in the case, and such finding shall be considered as evidence in any judicial proceedings.

Sec. 15 and 16. If, after examination of a complaint, the Commissioners find violation of the law, they shall send a copy of their finding to the company in question, with instructions that such violation be stopped; and in case any railroad continues such practices as are complained of by the Commission, it is the duty of the Commission to apply for the necessary action through the courts.

Sec. 17. The Commission is directed to prepare freight schedules for each road, and to arrange for a freight classification, and shall publish such rates two weeks before they take effect. In case of revision they are to give notice to those interested to give their views on such revisions.

Sec. 18. When any person, firm or association makes complaint before the Commission that the rates so fixed are unreasonably high the Commissioners shall examine such complaint, and if it seems well founded shall appoint a hearing for both the complainants and the companies interested.

Sec. 19. Upon such hearing the Commission will receive

evidence from either party, and shall also procure as evidence rates made on similar articles in other parts of the state under the same circumstances. The testimony of a road that its traffic arrangements with roads outside of the state are a factor in fixing or maintaining the rates in question shall be considered in such evidence.

Sec. 20. After hearing such evidence the Commissioners have the power of changing the maximum rates in the cases referred to, and at the same time can change rates in similar shipments on other roads than those against which complaint was made.

Sec. 22 authorizes the Commission to require annual reports from the roads, with description of the items to be called for in such reports.

Sec. 24 defines different cases of discrimination, or extortion, or evasion, but exempts commutation or mileage tickets issued at the same rates to all applying.

Sec. 29 provides that this law does not act against reduced rates given on carriage for the United States, the state government, for families of employés, or to fairs and exhibitions, or half fares to ministers.

Sec. 30 provides that commissioners or their agents shall have free transportation on the roads of the state.

Sec. 31 appropriates $10,000 to cover expenses of any suits or expenses of the Commission investigations.

Sec. 33. The act shall take effect in 30 days after its publication.

NEW PUBLICATIONS.

The Lakes and Gulf Waterway. A Brief, with illustrations and notes. Published by the Citizens' Association. Prepared under the direction of Committee on Main Drainage. By L. E. Cooley, Civil Engineer. Chicago. 1888.

The Illinois & Michigan Canal was originally projected to afford a depth of 10 ft., which was at that time fully equal to the depth on the St. Clair Flats, which limited the trade between Chicago and Buffalo. The canal was commenced in 1836, but in consequence of the financial crash of 1837 its plan was so modified that a navigation of only 6 ft. in depth was completed in 1848.

Now the "Committee on Main Drainage" comes forward with a project based on the studies of Rudolph Hering and other engineers employed by the city of Chicago, proposing a channel 160 ft. wide and 22 ft. deep, 29 or 30 miles long, to carry 10,000 cu. ft. per second, with a current of two miles per hour, and costing, according to the uncompleted studies of the engineers, from $17,000,000 to $21 000,000. Two or three advantages are expected from this plan. The primary incentive to the investigation by the city of Chicago is the increasing contamination of its river by the sewage of the city. This will be carried through the cut with sufficient water to so dilute it that it will not be offensive to the inhabitants on the river banks until the population of Chicago is over 2,000,000.

By the aid of locks and dams in the Illinois River between Joliet and La Salle, eight or more feet of water could at all times be secured between Chicago and Grafton, the point at which the Illinois enters the Mississippi, thus adding 325 miles of navigable waterway to the Mississippi and connecting lake navigation with that system. The increased flow of 10,000 cu. ft. per second will, it is estimated, add 20 per cent. to the low water volume of the Mississippi between Grafton and Cairo. In fact, with the aid of 15,000 cu. ft. per second, to be derived from the reservoirs on the upper Mississippi and its tributaries, Mr. Cooley expects the following increments to the depth of that river: From the Illinois to the Ohio, 2.3 ft.; Ohio to Arkansas, 1.4 ft.; Arkansas to Red River, 1.2 ft.

There is also another advantage to be derived from this improvement. From Chicago to Lake Joliet, 40 miles, there is a fall in the last 10 miles of 70 ft., and from there to La Salle, 60 miles more, there is a fall of 76 ft. This it is computed will give about 55,000 horse-power at Joliet and 45,000 horse-power below it. This power, with the facilities for transportation, would establish a very large manufacturing industry in the locality.

Chicago, according to the "Brief," cannot increase its present debt without either a constitutional amendment or an increase of its area and valuation. Hence it asks of the state, suitable legislation to enable it to do its part of the work at its own expense. And as a channel for sewerage purposes alone would cost less than one of combined utility for navigation and sewerage, it asks of Congress a survey, location, plans and estimates, enabling Chicago to pay the full cost of taking care of the sewage; "leaving to the United States only the expense of suiting the channel to the purposes of navigation and improving the river below."

The Brief contains in a compact form a great deal of useful information, historical and statistical, and is illustrated by maps and diagrams. It is unfortunate for Chicago's interest in this work that the supposed necessities of reform stopped the investigations of the able engineers who had the subject in hand before their studies were completed.

Tall Chimney Construction. A Practical Treatise on the Construction of Tall Chimney Shafts, Containing Details of upwards of Eighty existing Mill, Engine-house, Brick Works, Cement Works and other Chimneys in England, America and the Continent, constructed in Brick, Stone, Iron and Concrete. By Robert M. Bancroft and Francis Y. Bancroft. pp. viii., and 136, plates and index. Manchester.

The Messrs. Bancroft have in this work collected more or less full details of some 90 chimneys, built of brick, stone and iron, which vary in height from the Port Dundas, Glasgow, chimney 454 ft. high to chimneys of but little over 50 ft. high. Twenty-three of these chimneys are illustrated in the plates. In addition to specifications and bills of quantities for some of the chimneys we have descriptions of the fall of some and of the straightening of others. Notes are given on foundations, expansion, bricks, mortar, cement, stone, draught and stabilities.

Among instances of the demolition of chimneys an interesting one is of a glass works chimney in Ireland, 95 ft. high, 64 ft. diameter and 4½ ft. thick at the base, which was supported on twelve pillars of brickwork. On April 15, 1884, in compliance with a requisition sent to the military authorities, trained men were brought from Curragh, and a dynamo battery sent from Chatham to fire the charges, the work being under the superintendence of an officer of the Royal Engineers. The piers were first charged with 2¾ lbs. of cannon powder, closely tamped and fired from a distance of 150 yards. There were 12 simultaneous puffs of smoke, smalls portions of the brick work of the piers "slid slowly to the ground, the chimney stood as erect as before." Twenty pounds of powder were then placed under one of the arches and closely packed with sand bags. The wires were again connected and the charge exploded, destroying the sand bags. This apparently discouraged the trained men and officers, for the chimney was next attacked by a "bystander" with a chain, a truck and two horses, in an attempt to pull out one of the piers. The horses not proving more effective than the outfit of the Royal Engineers, an engine of the great Southern & Western Railway was brought into service, successively breaking its draw-bar, a chain and a 3-in. hawser, after which the chimney got disgruntled and fell when no one was near it.

TRADE CATALOGUES.

The Brown & Sharpe Manufacturing Co., of Providence, R. I., has issued a new edition of a neat little catalogue and price list, giving engravings and particulars of the great variety of the useful tools and gauges for which this firm are famous the world over. The catalogue under notice contains particulars of many ingenious and serviceable devices, and will be found a useful work of reference to all engaged in making accurate and interchangeable work.

Among the miscellaneous tools is a gas heater for tempering tools, an improved foundry rattler, a grindstone truing device, gauges for nuts and washers, a key seat rule for marking off key seats, and a hollow steel plumb bob filled with mercury, which, being heavy for its size, is useful where great accuracy is required.

TECHNICAL.

Car Notes.

The Jackson & Sharp Co., Wilmington, Del., has just delivered to the Philadelphia & Reading 30 passenger cars, and 15 more are nearly completed. The firm has also just delivered to the Delaware, Lackawanna & Western 20 passenger cars, and have more started.

The St. John (N. B.) shops of Harris, James & Co. are working on an order for seven Heater freight cars for the Intercolonial, and are also turning out three ordinary freight cars daily for the same road. The firm will soon erect a new car shed 225 ft. long.

The Youngstown (O.) Car Manufacturing Co. is building 50 cars for the Mather Stock Co.

The Anniston & Cincinnati has lately received two new passenger cars.

Bridge Notes.

The iron bridge at Pittsfield, Mass., which we noted last week, is to be built over the North Adams track of the Boston & Albany Railroad, and will be 58 ft. long, with a clear width of 19 ft. The skew of the bridge is 32 deg., and the capacity is to be 100 lbs. to the square foot of moving load, factor of four. Bids will close May 1. Address H. J. Jones, Chairman of the Selectmen, Pittsfield, Mass.

Proposals are asked until May 1 for the erection of a wrought iron bridge at Clinton, Mass. It is to have two 92 ft. spans. Address S. Anderson, Clinton, Mass.

The Rochester Bridge & Iron Works of Rochester, N. Y., are constructing a bridge across the tracks of the New York Central & Hudson River, and the Delaware, Lackawanna & Western at Utica, N. Y., for the Delaware & Hudson Canal Co.

The New York, Ontario & Western is constructing a bridge over the tracks of the New York Central & Hudson River at Utica to connect its tracks with those of the Rome, Watertown & Ogdensburg. An iron drawbridge is also being constructed over the Erie Canal.

The Boston Bridge Co. is building four bridges for the Fitchburg Railroad. The Edge Moor Iron Co., of Wilmington, Del., is also building three bridges on the Troy & Boston Division, and the Keystone Bridge Co., of Pittsburgh, Pa., has nearly completed a five span bridge over the Green River. The last named firm is also building a 60 ft. iron plate girder bridge in 3 spans for the Providence, Warren & Bristol.

The Iron City Bridge Works, of Pittsburgh, Pa., are building an iron bridge across the Scioto River, near Waverly, O. The bridge is of three spans of 152 ft. each, and is to take the place of a combination bridge which was built in 1878.

The Connecticut River road is erecting five iron bridges, varying in length from 100 to 200 ft. each.

Bids will be received until May 16 by the City Council of Fort Gaines, Ga., for repairing the bridge across the Chattahoochee River at Ft. Gaines. There will be about 200 ft. of lattice work, 80 ft. of abutments and one brick pier 60 ft. high.

The Virginia Midland is constructing 1,100 lineal feet of iron truss bridging and 1,700 feet of viaduct bridging to take the place of wooden structures.

The Detroit Bridge & Iron Works are constructing bridges over the Grand and Thornapple rivers in Michigan for the Detroit, Lansing & Northern.

An iron bridge, with five spans, each of 125 ft., has been erected over the James River, at Richmond, Va., by the Richmond & Danville. A three-span iron bridge of 150 ft. has also been erected over the French Broad River, near Hot Springs, N. C., on the Western North Carolina Division.

The Hot Springs (Ark.) road has lately completed two iron bridges with spans of 85 ft. each, with granite abutments, at a cost of $18,000.

The Massillon Bridge Co., Massillon, O., is constructing a two-span iron bridge, each span 125 ft. long, over the Emporras River for the Indianapolis & Illinois Southern.

The South Carolina road is constructing draw-bridges over the Congaree and Wateree rivers, which have clear openings of 62 ft.

The Berlin Iron Bridge Co., of East Berlin, Conn., has lately completed an iron bridge at Torrington, Conn., for the New York, New Haven & Hartford.

The Passaic Rolling Mill Co., of Passaic, N. J., and the Edge Moor Iron Co., of Wilmington, Del., have completed five bridges aggregating about 800 ft. on different divisions of the Atlantic Coast Line.

The Lassig Bridge Co., of Chicago, has built a 750 ft. bridge of five spans for the Illinois Valley & Northern.

The two shore piers and pivot pier of the Arthur Kill bridge are finished; two more piers will be completed in about four weeks. The erection of the draw span will be completed in about five weeks. The iron for the fixed spans is delivered on the ground.

The contract for constructing an iron bridge across the Farmington River, at Collinsville, Conn., has been let to the Berlin Iron Bridge Co., of East Berlin, Conn.

An iron bridge will be built at Houlton, Me., at a cost of $10,000 to replace the wooden one across the Meduxnekeag River.

Manufacturing and Business.

Contracts for furnishing machine tools for the Norfolk Navy Yard have been awarded as follows: Niles Tool Works, of Hamilton, O., $20,800; Wm. Sellers & Co., of Philadelphia, $11,391; Morgan Engineering Co., of Alliance, O., $4,560; Bement, Miles & Co., of Philadelphia, $8,375; Manning, Maxwell & Moore, New York, $2,450.

The Boston Heating Co. has recently purchased 45 Curtis Pressure Regulators from ¼ to 3 in. in size, to reduce 400 lbs. street pressure to from 5 to 80 lbs. for heating and power. The larger ones control the pressure on the pumps at the central station.

The New York Iron Roofing & Corrugating Co. report that they have recently received orders for covering two large elevators in Buffalo and several other large orders. They have just completed an order for 30,000 ft. for Troy, and have just supplied the iron complete for several new depots for the Mexican Central, and last week made a large shipment to Western Mexico.

Holmes, Booth & Haydens report several large sales of their "K. K." wire for electric railroad purposes.

The Thomson-Houston Electric Co. has recently received orders as follows: Sioux City, Ia., Electric Light Co., 35 arc and 650 incandescent lights; Lawrence, Kan, 60 arc lights; Pella, Ia., 300 incandescent lights; an additional order for 30 arc lights for Houghton, Mich.; an additional order for 35 arc lights for the Akron, O., Citizens' Electric Light Co.; and Ionia, Mich., 20 arc and 500 incandescent lights.

Charles A. Ashburner, Engineer of the Fuel, Gas and Electric Engineering Co., of Pittsburgh, Pa., has gone to San Francisco to introduce the Westinghouse fuel gas system.

The Louisville Water Co., Louisville, Ky., has awarded the contract for pumping engine machinery and boilers to the I. P. Morris Co., of Philadelphia, Pa., for $235 000, and the contract for engine house, engine foundations and caisson complete, and the inlet and river work to the Scoysmith Co., of New York, at $172,190.

The Consolidated Coupling Co. has removed its offices from 173 Broadway, N. Y., to the Aldrich Building, at 45 Broadway.

The secretary of the Cincinnati Corrugating Co. has recently sent out a circular calling the attention of builders and engineers to the fact that architects and mechanical engineers in specifying length of corrugated sheets or in basing supports for them on iron framed roofs, often, if not ordinarily, specify lengths different from those carried in stock. It is suggested that time and money could both be saved by designing the structure for the standard lengths, which vary by single feet from 5 up to 10 ft. Large stocks of regular lengths and of various gauges are kept at various points throughout the country, the company now carrying over 1,500 tons in stock.

The Mercer Rubber Co., of Trenton, N. J., have erected new machinery for rolling a fine grade of thin stock, and will start this addition at once. The works are crowded with orders and have been running nights during the last month.

Iron and Steel.

The Trinidad Rolling Mills & Iron Co. has been organized at Trinidad, Col., with a capital stock of $200,000, by Henry Schneider, Harry E. Mulnix and others to manufacture iron and all its products. The office of the company is to be in Trinidad.

Messrs. Carnegie, Phipps & Co. started up their Edgar Thomson Steel-Works at Braddock, Pa., April 23, with about 500 hands.

The Cambria Iron Co., at Johnstown, Pa., has issued an order that all Sunday work be suspended in the steel-works and blooming mills, and as far as possible at the blast furnaces.

Mackintosh, Hemphill & Co., Limited, Pittsburgh, Pa., will make extensive improvements in the Fort Pitt Foundry. A brick building 220 × 115 ft., and an iron structure 220 × 90 ft. are being erected. Eight new traveling cranes, two that will have a capacity of 25 tons each and the others 15 tons each, will be erected.

Miller, Metcalf & Parkin, of Pittsburgh, Pa., have ordered a new Bessemer blowing engine, which is now being built by E. P. Allis & Co., of Milwaukee.

Dilworth, Porter & Co. have put in a new continuous train in their spike mill, which is giving much satisfaction.

The Illinois Rolling Mill Co. has been incorporated in Illinois with a capital stock of $300,000, by J. L. Pfau, Jr., and others. Mills will be erected at Chicago, and it is expected that they will be in blast in a short time. Mr. Pfau is Secretary of the Etna Iron & Steel Co.

Lean & Blair, of Pittsburgh, Pa., have contracted to build an open-hearth steel plant at Findlay, O., for the Kellogg Seamless Tube and Manufacturing Co.

Car Heating Notes.

The Martin Anti-Fire Car Heater Co. has received orders to equip 25 more baggage cars and 20 more engines of the New York Central & Hudson River. The new shops at Dunkirk, N. Y., will soon be occupied.

A Device for Extinguishing Fires and Lights in Derailed Cars.

On Tuesday of last week the Berry fire and light extinguisher was exhibited before the railroad commissioners and others at the Boston & Lowell station in Boston. A car of the Concord Railroad was fitted with the extinguisher, and the experiment is reported to have been satisfactory. The extinguisher consists of a device for automatically releasing air from the brake pipes whenever the car shall have tipped to an angle of 30 degrees. The automatic action consists merely of the falling or sliding of weights when the car tips, thus opening valves which permit of the free passage of a current of the compressed air through tubes and into the lamp chimneys in the car, extinguishing the light; and through a second series of tubes into a cylinder, where the air forces a piston upon a chamber containing a chemical extinguishing compound, which is in turn forced through an outlet into the car stove.

Interlocking on the Old Colony.

The grade crossing at Mansfield, Mass., of the Boston & Providence road, and the Fitchburg-New Bedford line, now both operated by the Old Colony, has just been fitted with interlocking signals by the Union Switch & Signal Co. The tower, which operates a number of switches and signals besides the crossing signals, has 80 levers. The main line semaphore signals have the illuminated blade illustrated in the *Railroad Gazette* of March 30.

The Emmert Car Seat.

The Chicago & Alton has given an order for Emmert car seats, for two cars made by the Johnston Car Seat Co., Chicago, and the St. Louis & Hannibal road has also adopted it. This makes six roads which have decided to use this seat, for which not even a pattern was made prior to Jan. 1. The Burlington, Chicago & West Michigan, Grand Rapids & Indiana, and the Detroit, Lansing & Northern all have orders in for it.

Mount Pilatus Rack Railroad.

This road was described in the *Railroad Gazette*, Feb. 4, 1887. It is about 2½ miles long, and the difference of altitude of the termini is nearly 5,300 ft. The heaviest grade is 48 per cent. The motor designed for it is entirely different from any type heretofore made. Its principal dimensions were given in the account referred to. It was expected that the work would be completed by the summer of 1888, but our German exchanges now state that it will probably not be done till June 15, 1889. The contract price is said to be $410,000.

Patent Turpentine.

The best quality of turpentine is that obtained from Pinus Larix and is known in commerce as Venetian turpentine. Dr. E. Schaal, of Stuttgart, has obtained a patent in Germany for a method of producing from common resins an article equal for all purposes to the best turpentine, which can be used in the arts as a substitute for the genuine article, and is free of water, better in color and cheaper. Patent turpentine is of a watery or slightly yellowish color and very dense; it hardens if exposed to air for a long time. It is soluble in soda lyes, forming with it a fairly hard soap. It is also soluble in ammonia, ether, benzine, chloroform, spirits of turpentine, and in pure alcohol. It dissolves in equal parts of common spirits if this is warm, while with cold spirits from 5 to 10 parts spirits to one of turpentine are necessary to obtain a solution. In sulphuric acids it forms a reddish solution, out of which it precipitates as a dark resin if water is added to the solution. Patent turpentine differs from Venetian turpentine by its smaller solubility in alcohol, its greater purity, freedom from water and clearer color.

Train-Number Indicators.

The Alabama Great Southern is fitting its engines and cabooses with Parsons' device for showing the number of a train on the front of the headlight and from the windows in the clerestory of the caboose.

THE SCRAP HEAP.

Massachusetts Institute of Technology.

Entrance examinations for 1888 will be held in Boston May 13 and June 1; also Sept. 18 and 19. Examinations on the same days will be held in 12 other cities of the country, including San Francisco and Santa Fe. Information in regard to requirements, etc., can be had by addressing James P. Munroe, Secretary Massachusetts Institute of Technology, Boston, Mass.

Coal Production in the United States and Great Britain.

Mr. Frederick E. Seward's tables in *The Coal Trade* enable us to continue our table of July 8, last year, showing the production of coal in this country and Great Britain for the past three years. The production in gross tons has been:

	1885. 1 = 1,000	1886.	1887.
United States	95,833	96,145	107,238
United Kingdom	159,351	157,418	162,120

The increase in this country was at the rate of 12½ per cent. In the United Kingdom the increase was at the rate of 3 per cent.

Georgia and Utah have not increased their production, and California and Montana have suffered a slight decrease. Alabama has made an increase of only 500,000 net tons, less than might be expected. Virginia and Missouri record the same increase. Tennessee and West Virginia follow with 400,000 tons increase, while Iowa and Kansas have each increased their output by about 300,000 tons. Iowa, which is preceded by Pennsylvania, Ohio, Illinois and West Virginia, is the fifth state in rank as a coal producer, being followed closely by Missouri, Indiana and Alabama. About 8,000,000 tons of coke were made; three-quarters of this was produced in the Connellsville region.

The number of persons employed "in the coal industry" was approximately 237,800 in this country. In the United Kingdom the total number of persons employed "in and about the mines" was 526,277, of whom 4,183 were females working above ground; this number, including as it does all working under the Coal Mines Act, probably is not fairly comparable with the number of persons returned in this country.

Compulsory Salaries.

Bill Nye has been studying the proposed bill to license conductors, and sees some beauties in it which are not discerned by the unpoetic eye. Some points, as he reads them, are:

"Examiners shall have $2,500 per year, reasonable traveling expenses and 10 cents per mile by the most devious method of travel. Railroad lines will be permitted to pass Chief Examiners, Supervising Examiners, etc., to and from their work. The Chief Examiner and Supervising Examiners shall constitute a National Board, to meet at Washington every little while to think it over and then go away. This National Board of Examiners shall divide our unhappy country into twenty districts, each of which shall be cheered by the presence of two District Examiners, and they shall be men of good moral character, who can ask difficult questions and be willing to work on a salary. They shall receive a salary of $2,000 per year, mileage, stationery and press notices. The duties of District Examiner as prescribed are optional, but the salary is compulsory. * * *

"The Chief Examiner, Supervising Examiners, District Examiners and Assistant District Examiners shall be at all times guarded by a cloud of mileage by day and a pillar of salary by night.

"Under the provisions of Section 8 of the Act the District Board of Examination shall have power to pry into the pedigree, personal habits, qualifications, aims, aspirations, accomplishments and physical condition of any man who may make application for the portfolio of conductor or door-slammer extraordinary as provided in this Act; and further, it is provided elsewhere in the bill that no conductor shall be permitted to go through a train with a pencil in his mouth, a pair of forceps in one hand and a pad of drawback checks in the other, acting as a conductor, a treasurer, a nurse, a railway folder, map and household guide, at $80 per month, with the privilege of being killed between meals, unless he shall have passed a thorough examination on the same track and received a license from the Board of Examiners and paid a fee of $5 to said board. The bill also provides that the sum of $100,000 shall be appropriated for the contingent expenses of the board in getting to and from widely separated points, and for wear and tear of thinkers while engaged in getting up deep conundrums for applicants." * *

RAILROAD LAW—NOTES OF DECISIONS.

Powers, Liabilities and Regulation of Railroads.

In New York a turnpike company placed a railroad track upon its road, under a grant from the legislature. Subsequently the legislature brought the land within the boundaries of a municipality. The Court of Appeals hold that after this the municipal authorities could regulate such street as its other streets were regulated, and could compel the company to relay its rails flush with the grade of the street, and so as to leave a passage for vehicles on each side.[1]

In the same state the Court of Appeals decides that to authorize a corporation to take property for railroad purposes, under the eminent domain law, it must show first a legislative authority and second that the business in which it is engaged is a public one. Here it appeared that the proposed railroad had no proper termini; that it was not a highway; that it could not transport freight (a duty the corporation had undertaken to perform); that it could be operated but a portion of the year; and that its sole object was to enable the corporation, for a compensation, to provide a portion of the public who might visit Niagara Falls better opportunities for viewing the natural attractions of the locality. This the Court says is not a public purpose which justifies the exercise of the right of eminent domain.[2]

In another case in the same state the Court of Appeals lays it down that property cannot be taken except under the express grant of the legislature, and that the charter of the Poughkeepsie Bridge Co. limits it to a single exercise of choice in the location of the bridge and its approaches, which, when once exercised, cannot be changed for another, and that the fact that the charter of the bridge company states that it shall have the right to acquire land in the same manner as is provided for obtaining land for the purposes of a railroad, under the 14th section of the General Railroad act, does not incorporate in the charter the provisions of the General Railroad act which empower railroads to change their routes and to acquire lands for the changed routes.[3]

In Indiana the Supreme Court holds that one about to purchase land upon which a grade for a railroad company is constructed is warned thereby that there is some claim of right, and, if he fails to make proper inquiry as to the nature of the claim, he buys at his peril.[4]

In the same state the same Court rules that while the state has the power to take land in fee for a public use, and may confer such power upon a railway company or other corporation, yet unless the act from which the power to take is derived in express terms confers the power to take the fee, or unless the retention of the fee by the landowner would be necessarily inconsistent with the use for which the land is appropriated, the presumption will be indulged that only an easement is to be taken.[5]

In Kansas the Supreme Court rules that a husband cannot, without the consent of his wife, grant or alienate the right of way of a railroad across land owned by him and occupied as a homestead by his family. But the wife's consent need not be in writing, it may be proved like any other fact.[6]

Carriers of Goods and Injuries to Property.

A statute of South Carolina provides that no public notice or special contract shall limit or affect the liability at common law of any railroad company with that state. The Court of Appeals of New York rules that this cannot affect the validity of a contract made in that state to limit the liability of a railroad company in some other state. In the same case the same Court holds that where a bill of lading provides that the carrier shall be entitled to the benefit of any insurance upon the property covered thereby, payment by the insurance company to the owner of the property of the full amount of his loss discharges the carrier from all liability, and the insurance company then has no right of action against the carrier on the theory of subrogation.[7]

Where you prove that fire escaped from a locomotive, and you also show that there are inventions which will prevent the escape of fire, in use on other engines, you raise an inference that the fire in the particular case escaped on account either of the defective construction or the improper management of the locomotive. So says the Court of Appeals of New York. The Court also rules that where a railroad company leaves a car containing goods so near a freight house (which the company has reason to apprehend might take fire at any time from a passing engine) as to be exposed to the hazard of fire communicated from such freight house, this is negligence on its part.[8]

In Alabama, the Supreme Court holds that where a railroad company, as a common carrier, receives cattle for transportation over its road, to be delivered at its terminus to the next connecting road, and thence by other connecting roads to the place of destination in other state, the duty of the receiving road is limited to the safe transportation of the cattle over its own road, and their proper delivery at the terminus of its road to the next connecting road. But it cannot limit its liability to injuries caused by "gross or wanton negligence," nor to that of a mere agent of the consignor in the matter of delivering the cattle to the next connecting road; such stipulations being contrary to public policy.[9]

In Pennsylvania A. & Co. shipped by rail a carload of goods from Michigan to Pennsylvania, consigned to themselves. At the same time they drew on B. in Pennsylvania for the amount of the shipment at forty-five days, and, attaching the bill of lading to the draft, sent the same through the bank for acceptance and collection. They also wrote B. notifying him of the shipment, that they had drawn on him "as per arrangements. Please protect draft," and inclosing an invoice for the goods which referred to the draft and bill of lading. On the production of this letter and invoice, the agent of the carrier delivered the car to B. B. never accepted the draft, subsequently failed, and never paid for the goods. In an action by A. & Co. against the carrier, the Supreme Court holds that the delivery by the defendant's agent was improper, and the defendant was liable for the losses occasioned A. & Co. by reason thereof, and that A. & Co. did suffer a loss thereby, because if the draft had been accepted it might have been paid notwithstanding the failure of B., or A. & Co. might have sold it without recourse. In this case there was evidence that the defendant company had on more than one occasion delivered goods from the same shippers to B. prior to the acceptance of the drafts. These drafts had, however, been afterward accepted and paid. B. testified that A. & Co. knew this fact. The Court rules that this evidence would not have justified the jury in finding that A. & Co. had acquiesced in such an arrangement, or had consented to the delivery of this particular carload without the production of the bill of lading and acceptance of the draft.[10]

Injuries to Passengers, Employes and Strangers.

In Pennsylvania, at the point where the accident occurred, the railroad had been crossed by a path. Some years before a station platform had been erected, the western end of which was at the point where the path crossed the road. Behind the platform a barbed wire fence had been put up, crossing and cutting off the path and extending for some distance parallel to the railroad. Between the fence and the tracks was a ditch from which there was a rise to the railroad embankment where it was possible to step upon the platform by means of a projecting string piece. It appeared that many persons had been in the habit of approaching the station by this path, stooping under the wires and climbing up the bank. On the day of the accident the deceased was in a great hurry to reach a train, and the regular approach to the station being blocked by a freight train he choose the way by the path, and in attempting to get upon the platform was struck and killed by a passing train. The Supreme Court decides that the railroad is not responsible, saying: "That he was a trespasser, and brought upon himself the misfortune which befell him is not doubtful. Nothing could be more obvious than that the railroad did not intend that passengers should reach its station by the way and in the manner he chose to adopt. The ditch and the character of the ground were of themselves sufficient notice of this fact; but, in addition, the wire fence under which he had to stoop to reach the point of the accident was a positive warning that in passing it he assumed every risk that might possibly occur on his way to the train which he intended to board."[11]

In Maine the Supreme Court holds that a railroad is liable to a brakeman of another road for a personal injury while in the performance of his duty on his employer's train, caused solely by reason of the negligent construction of the former's station-house, which the latter road uses. When a railroad company leases its road, it is still liable, to one lawfully on the premises, for a personal injury which resulted solely from the original defective construction of its station-house, if it has not been exempted from such liability by legislative authority.[12]

[1] City of Albany v. W. T. & R. Co., 11 Cent. Rep., 85.
[2] Re Niagara Falls & Whirlpool R. Co., 11 Cent. Rep., 273.
[3] Re Poughkeepsie Bridge Co., 11 Cent. Rep., 283.
[4] Ind., Bloom. & West R. Co. v. McBroom, 13 West. Rep., 332.
[5] Quick v. Taylor, 13 West. Rep., 350.
[6] Pilcher v. A., T. & S. F. R. Co., 16 Pac. Rep., 945.
[7] Platt v. R., Y. R. & C. R. Co., 11 Cent. Rep., 101.
[8] Tanner v. N. Y. Cent. & H. R. R. Co., 11 Cent. Rep., 82.
Alabama G. S. R. Co. v. Thomas, 3 South. Rep., 862.
[10] Penn. R. Co. v. Stern, 11 Cent. Rep., 387.
[11] Comey v. Penn. R. Co., 11 Cent. Rep., 206.
[12] Nugent v. B., C. & M. R. Co., 5 N. Eng. Rep., 865.

General Railroad News.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Baltimore & Ohio, semi-annual, 5 per cent. on the Washington branch, payable April 25.

Nashua & Lowell, semi-annual, 4½ per cent., payable May 1.

Wheeling & Lake Erie, quarterly, 1 per cent. on the preferred stock, payable May 15.

Railroad and Technical Conventions.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *International Association of Car Accountants* will hold its annual meeting in Montreal, Can., June 19.

The *American Institute of Mining Engineers* will hold its fifty-first meeting at Birmingham, Ala., commencing May 15.

The *American Society of Mechanical Engineers* will hold its seventeenth meeting at the Maxwell House, Nashville, Tenn., May 8 to 11.

The *American Train Dispatchers' Association* will hold its fifth annual meeting at Louisville, Ky., June 12.

The *National Association of General Passenger and Ticket Agents* will hold its fall meeting in Saratoga, N. Y., Sept. 18.

The *National Association of General Baggage Agents* will hold its next meeting in New York City July 18.

The *Master Car-Builders' Association*, annual convention, Alexandria Bay, N. Y., commencing June 12.

The *American Railway Master Mechanics' Association*, next annual convention, Thousand Islands, N. Y., June 19.

The *New England Railroad Club* meets at its rooms in the Boston & Albany passenger station, Boston, on the second Wednesday of each month.

The *New York Railroad Club* meets at its rooms, 113 Liberty street, New York City, on the third Thursday of each month.

The *Western Railway Club* meets in Chicago the third Wednesday in each month.

The *Central Railway Club* meets at the Tifft House, Buffalo, the fourth Wednesday of January, March, May, August and October.

The *American Society of Civil Engineers* holds meetings on the first and third Wednesday in each month at the House of the Society, 127 East Twenty-third street, N. Y.

The *Boston Society of Civil Engineers* holds its regular monthly meetings at its rooms in the Boston & Albany station, Boston, at 7:30 p. m. on the third Wednesday of each month.

The *Western Society of Engineers* holds its regular meetings at its hall, No. 15 Washington street, Chicago, at 7:30 p. m., on the first Tuesday of each month.

The *Engineers' Club of St. Louis* meets the first and third Wednesday of each month till June.

The *Engineers' Society of Western Pennsylvania* meets in Pittsburgh the third Tuesday of each month.

Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Atchison, Topeka & Santa Fe, annual meeting, Topeka, Kan., May 10.

Atlantic & Pacific, annual meeting, Boston, Mass., May 17.

Bay View, Little Traverse & Mackinaw, annual meeting, Harbor Springs, Mich., May 2.

Canadian Pacific, annual meeting, Montreal, Que., May 9.

Chicago & Birmingham, special meeting, Fayetteville, Ga., May 1.

Chicago, Burlington & Quincy, annual meeting, Chicago, Ill., May 16.

Chicago & Northwestern, annual meeting, at the office in Chicago, Ill., June 7.

Chicago & Ohio River, annual meeting, Grand Pacific Hotel, Chicago, Ill., May 3.

Chicago, Rock Island & Colorado, special meeting, Denver, Col., April 30.

Connecticut River, special meeting, at the office in Springfield, Mass., May 4.

Delaware & Hudson Canal Co., annual meeting, 21 Cortlandt street, New York, May 8.

Denver & Rio Grande, annual meeting, Denver, Col., May 22.

Detroit & Bay City, annual meeting, Detroit, Mich., May 3.
Eastern, in New Hampshire, annual meeting, Portsmouth, N. H., May 1.
Harrisburg & New England, annual meeting, Philadelphia, Pa., May 7.
Lake Shore & Michigan Southern, annual meeting, Cleveland, O., May 2.
Lehigh & Eastern, special meeting, Philadelphia, Pa., May 9.
Louisiana & Missouri River, annual meeting, St. Louis, Mo., May 2.
Missouri, Kansas & Texas, annual meeting, Parsons, Kan., May 16.
Michigan Central, annual meeting, Detroit, Mich., May 3.
New York, Chicago & St. Louis, annual meeting, Cleveland, O., May 2.
New York & Harlem, annual meeting, New York City, May 15.
Norfolk & Western, annual meeting, Roancke, Va., May 2.
Omaha & St. Louis, annual meeting, Stanberry, Mass., May 15.
Pennsylvania & Western, Philadelphia, Pa., May 2.
Pittsburgh, Fort Wayne & Chicago, annual meeting, Pittsburgh, Pa , May 16; special meeting, June 13.
Pueblo & Arkansas Valley, annual meeting, Pueblo, Col., May 12.
Richmond & Danville, special meeting, Richmond, Va., May 21.
St. Louis, Arkansas & Texas, annual meeting, St. Louis, Mo., May 3.
Topeka, Salina & Western, annual meeting, Topeka, Kan., May 1.
Vicksburg & Meridian, annual meeting, 40 Wall street, New York, May 7.

Engineers' Society of Western Pennsylvania.

A regular meeting of the society was held April 17, attended by 56 members and 4 visitors. The President, both Vice-Presidents, and all the Directors were present.

Geo. H. Barbour and Lewis B. Fulton were elected members.

Phineas Barnes read an interesting paper on Aluminum, the discussion of which was participated in by A. E. Hunt, Wm. Metcalf, T. B. Roberts, Brashear and several others.

American Institute of Mining Engineers.

The fifty-first meeting of the Institute will be held at Birmingham, Ala., beginning Tuesday evening, May 15, 1888. Communications concerning the meeting may be addressed to Mr. Kenneth Robertson, at that place.

No special railroad rates for members attending this meeting have been arranged.

It is expected that after the sessions at Birmingham, the Institute will visit Anniston, Ala., and the interesting mines, furnaces and shops in that vicinity. Since the accommodations for ladies at Birmingham are limited, it is suggested that ladies accompanying members should remain at the Anniston Inn during the Birmingham sessions. The special rates at the Anniston Inn for members and ladies will be $2 per day. Communications engaging rooms, etc. should be addressed to Mr. Alfred L. Tyler, Anniston, Ala.

Engineers' Club of Philadelphia.

A regular meeting was held April 7, 1888, Vice-President John T. Boyd in the chair; 39 members and 1 visitor present.

The Secretary presented, for Mr. Frederic H. Robinson, a decription of the electric street railway at Wilmington, Del. Mr. Wm. H. Robinson presented an illustrated paper upon rope or cable as a transmitter of power.

The Secretary presented, for Mr. C. A. Preston, a description of the effect of gases, etc., from stacks upon iron, illustrated by a drawing of the Charles st. bridge over the N. C. Ry. tracks at Union Station, Baltimore, Md., and by a very complete and interesting set of specimens of iron from the bridge.

Mr. Herbert Bamber presented notes upon two experiments with cement mortar.

Mr. Howard Murphy presented a diagram showing the results of Watertown Arsenal tests of the crushing strength of Potomac red sandstone and other building stones, bricks and brick masonry. The diagram shows the following:

No. of tests.	MATERIAL.	Crushing strength in lbs. per sq. in.	
		From	To
6	Lee, Mass., marble	20 504	22 900
10	Potomac red sandstone	16,625	22,102
2	Conshohocken, Pa., limestone	14,090	16,340
2	Hummelstown, Pa., sandstone	12,810	14,610
6	Montgomery Co., Pa., blue marble	9,590	13,700
3	Philadelphia pressed bricks	7,210	9 050
4	Indiana limestone	7 190	10,620
11	Philadelphia hard bricks	5,540	20,830
10	Ohio sandstone	3 940	16 280
6	Philadelphia brick masonry in cement mortar	1,600	2,685
6	Philadelphia brick masonry in lime mortar	799	1,914

He also noted the other qualities of the Potomac red sandstone which are of special value to the engineer in construction—its durability under the action of frost, fire and wear, and its resistance to dampness.

Mr. Edward Hurst Brown mentioned that the reason the Potomac red sandstone was not more used for architectural purposes was that, while of a beautiful color, owing to its extreme hardness it was very difficult to dress, and also that very often in an apparently perfect stone a flaw would develop in dressing the face which would render it useless for facing stone. He also mentioned having seen at Brentsville, Prince William Co., Virginia, an old church built of practically the same stone, taken from the neighboring Bristow Quarry, which had stood for over 100 years, exposed to war and the elements, and which showed no signs of defects due to frost or action of the weather.

In consequence of the lateness of the hour, a communication by Mr. G. Y. Wisner, C. E., for years connected with the Lake Survey, entitled "The Physical Phenomena of Lake Harbors" was submitted by title. It shows that the progressive movement of sandy spits is attributable to the resultant waves and currents produced by the periodic oscillations of the lake surface, and that the effects are similar to those produced by the flood-tide on the Atlantic Coast, as explained by Prof. L. M. Haupt in his paper on the Physical Phenomena of Harbor Entrances.

Engineers' Club of St. Louis.

A regular meeting was held April 18. The regular order of the day was a consideration of a communication from the Council of Engineering Societies on the Reorganization of National Public Works. A committee consisting of F. E. Nipher, S. D. Russell and A. W. Hubbard, was appointed to consider what further action should be taken by the club concerning the National Public Works movement.

Mr. S. D. Russell read a paper on Thickness of Water Pipe, with some experiments on ram, illustrated by charts, tables and formulæ. He showed that great discrepancies exist between standard authorities on the question of thickness of pipe. There was discussion by several members of the society.

Engineers' Club of Kansas City.

An adjourned meeting was held April 16. The President reported in brief the action taken by the delegates at Washington, respecting the Cullom bill to create a Bureau of Harbors and Waterways. He said that there would be no difficulty in the passage of the bill by the Senate, and that in the House no great opposition was looked for.

The discussion of Prof. Waddell's pamphlet on Bridge Specifications was continued. Contributions were read from Mr. W. H. Breithaupt, Prof. de Volson Wood, Prof. P. C. Ricketts, Messrs. Artingstall, Thatcher and Cowles. There was also considerable verbal discussion. Resolutions were then adopted by the club to the effect that a committee of three be appointed by the President to prepare and form a memorial to the Legislature of the state, with a draft of a law to inaugurate a proper inspection of bridges; that the Secretary be instructed to notify other engineering societies and clubs of this action and solicit their co-operation. Mr. Chanute mentioned the following measures as proposed for effecting the desired reform: The employment of expert engineers, the use of legal standards of strength, the formation of a responsible association of bridge builders, state inspection, as now in use in Massachusetts and New York. The Chair appointed as committee Messrs. Chanute, Waddell and Breithaupt.

Boston Society of Civil Engineers.

A regular meeting was held April 18. President Fitz-Gerald on assuming the chair made a brief address, outlining the policy of the society. Among other things he gave the following programme of topics to be treated during the year: May, the Society will take up the subject of Separate System of Sewerage; in June, Dams; September, Drainage; October, Rapid Transit; November, Municipal Engineering; December, Topography; January, Duty Tests; February, Railroads; April, Mills; May, Bridges.

The following were elected members: Fred. H. Barnes, Nathan S. Brock, William H. Chapman, Louis Cutter, William C. Hall, Frank L. Locke, Arthur G. Robbins, George E. Whitney, J. L. Woodfall and Ed. E. Young.

The President announced the death of Henry F. Walling, a member of the society, and a committee was appointed to prepare a memoir.

The following special committees were appointed under authority of the vote of the Society: Weights and Measures, Charles H. Swan, Charles W. Cattell and Charles W. Folsom. On National Public Works, William E. McLintock, Sidney Smith and L. Frederick Rice.

A paper was read by Mr. L. Frederick Rice, chairman of the commission appointed by the Society of Boston to test meters, entitled, The Methods and Apparatus Used in Recent Tests of Water Tests at Boston. Mr. E. B. Weston read a paper entitled, Notes on the Water Meter System of Providence, R. I. Considerable discussion followed.

American Society of Civil Engineers.

A regular meeting was held April 18, Mr. J. J. R. Croes in the chair. The Secretary announced the deaths of Gen. Q. A. Gilmore and Mr. George Emerson, members of the society.

The announcement was made that the annual convention would be held at Milwaukee probably in the last week in June.

The subject for the evening was The Manufacture of Brick. The Secretary read a letter from Mr. Purrington, brickmaker, of Purrington, Ill. He does not use the clay from the Chicago River, on account of its wetness; the clay underlying the city, can, however, be used. He uses a steam shovel for excavation and a dumping track for handling the clay. The drying tunnels are 36 in. wide by 48 in. high, and steam is removed by an exhaust fan. Oil fuel is used.

Mr. José Villalon described the works of the American Brick and Tile Works at Phillipsburg, N. J., and the manufacture of bricks from crushed slate. While these are more expensive than clay bricks, the cost is offset by their advantage for high walls and structures, on account of their greater compressive strength, which is about 7,200 lbs. as against 3,200 lbs. for Philadelphia pressed brick. They also absorb much less water than ordinary brick. Samples have been tested by Mr. Church, Chief Engineer of the new Croton Aqueduct, in his researches to determine the resistance of different materials to percolation by water under high pressure.

Mr. Calvin Tomkins said that drying by steam is better than by hot air, as there is less liability to checking. Experiments with oil fuel at Haverstraw have been satisfactory, the heat being steady, easily controlled, and the loss from checked bricks in the arches less.

PERSONAL.

—Benjamin Wilson, Superintendent of the Louisville, New Orleans & Texas, has resigned, taking effect May 1.

—F. K. Morris, Secretary, and J. E. Bamberger, Purchasing Agent of the San Pete Valley road, have severed their connection with that company.

—G. W. Bentley, General Manager of the Jacksonville, Tampa & Key West, has resigned, to take effect April 30. He has been General Manager of this company since July, 1883, and is well known as a veteran railroad manager in New England and New York.

—Mr. J. W. Post, of the Dutch State Railroads, whose name is well known to our readers, was awarded a silver medal at the last yearly meeting of the French Society for the Encouragement of the Industries. The medal is in recognition of his services in improvement of permanent way.

—William B. Dinsmore, President of the Adams Express Co., died at his residence in New York City, April 20, at the age of 78. Alvin Adams, Mr. Dinsmore and John Hoey established the business of the express company in 1841, between New York and Boston. Mr. Dinsmore was a director of several railroads.

ELECTIONS AND APPOINTMENTS.

Central Ohio.—The following directors were elected at the annual meeting held in Columbus, O., this week: James H. Collins, Columbus; Walter B. Brooks, Baltimore; John R. Hall, Quaker City, O.; Daniel Applegate, Zanesville; Joseph W. Jenkins, Osmun Latrobe, Joshua G. Harvey, A. B. Crane, Baltimore; C. H. Kibler, Newark, Ohio; R. T. Devries, Newark, Ohio; Orland Smith, Cincinnati; W. W. Peabody, Madisonville, Ohio; David Lea, Zanesville.

Chicago, Milwaukee & St. Paul.—Roswell Miller has been elected President, to succeed Alexander Mitchell.

Chicago, St. Paul & Kansas City.—S. C. Stickney has been appointed Engineer of Maintenance of Way.

Chicago, Santa Fe & California.—V. H. Stevens has been appointed Train Master of the Kansas City Division, with headquarters at Marceline, Mo.

Forest City & Southeastern.—The officers of this new Dakota company are as follows: President, W. N. Grafflam, Boston, Mass.; Vice-President, R. M. Springer, Forest City; Chief Engineer, S. F. Bullard; Secretary, B. F. Bullard.

Garden City, Conductor & El Paso.—The directors of this new Kansas company are: George Trommlitz, Lamar, Colorado; H. P. Myton, S. H. Herbeson, B. H. Joy, C. E. Merriam, J. A. Stevens and I. R. Holmes, Garden City.

Illinois Central.—E. G. Russell has been appointed Assistant Division Superintendent, with headquarters at Cairo, Ill.

Indianapolis & Vincennes.—E. Hill has been appointed Engineer of Maintenance of Way, vice M. A. Zook, transferred.

Kanawha & Ohio.—At the annual meeting this week the following directors were elected: Lawrence Myers of Plainfield, N. J., C. O. Hunter of Columbus, William A. Quarrier of Charleston, Va., H. D. Whitcomb of Richmond, Va., J. M. Townskey of Elizabeth, N. J., Robert W. Kelly, Eli K. Robinson, George I. Seney, Grinnell Burt, Albert Gallup, and Walter B. Lawrence of New York.

Lehigh & Wilkesbarre Coal Co.—George S. Jones has been elected Secretary, with office in New York, succeeding C. R. Potts, resigned.

Lookout Mountain.—The following officers have been elected: E. Watkins, President; Hugh Whiteside, Vice-President; Gordon Lee, Secretary; and W. O. Peeples, Treasurer. General offices, Chattanooga, Tenn.

Los Angeles County.—E. H. Hall has been chosen President, with office in Los Angeles, Cal., to succeed M. L. Wicks, resigned. S. W. Lentweiler was chosen Vice-President.

Marshall, Paris & Northwestern.—The following are the officers of this company: President, John Martin, Paris, Tex.; Vice-President, S. J. Wright, Paris; General Manager, W. W. Hartsill; Secretary and Treasurer, E. J. Fry; Superintendent, L. W. Lloyd. General offices, Marshall, Tex.

New England General Ticket and Passenger Agents' Association.—The following officers were elected last week: President, O. H. Briggs, New York, Providence & Boston; Vice-President, J. A. Fenno, Boston, Revere Beach & Lynn; Secretary, C. A. Waite, Boston & Maine. The vacancy on the Executive Committee was filled by the appointment of F. E. Brown, Concord.

New York & New England.—Arthur Sewall has been chosen a director to succeed E. V. Cary, resigned.

Olympia, Gray's Harbor & Baker Bay.—The following are the incorporators of this company in Washington Territory: N. H. Owings, A. A. Phillips, A. H. Chambers, T. I. McHenny, G. A. Barnes, J. R. Hayden, and J. F. Gowey.

Oregon Pacific.—F. W. Bowen will hereafter, in addition to his duties as assistant to the General Manager, assume those of the Superintendent, vice C. R. Meeker, resigned.

Palmdale.—The officers of this short California road are as follows: H. C. Campbell, Sausalito, Cal., President; Lovell White, San Francisco, Treasurer; H. Clay Miller, San Francisco, Secretary. Directors, H. C. Campbell, O. C. Miller, Sausalito, Cal.; Lovell White, Arthur R. Briggs, San Francisco; and F. M. Butler, Oakland.

Pennsylvania Company.—L. F. Loree has been appointed Engineer of Maintenance of Way of the Cleveland & Pittsburgh Division, with office at Wellsville, O., vice Thomas Dickson, assigned to other duties.

Peoria & St. Louis Air Line.—The following were added to the Board of Directors at the annual meeting in Petersburg, Ill., for a term of three years: D. C. White, Forest City; Thomas R. McKee, Carlinville, and J. G. Strodtmann, Petersburg. The following officers were elected: T. W. McNeeley, President, Petersburg; E. W. Hayes, Vice-President, Bunker Hill; John A. Brahm, Petersburg, Treasurer; J. G. Strodtmann, Secretary, and Hobart Hamilton, Petersburg, Chief Engineer.

Raritan River.—The following officers have been elected: E. H. Ripley, President; C. B Hobart, Vice-President; W. G. Burnstead, Jersey City, Treasurer; Frank Earl, Secretary, and E. W. Harrison, Jersey City, N. J., Chief Engineer.

San Pedro, Los Angeles & Utah.—The following are the officers of this California company: President, J. P. Woodbury, Pasadena, Cal.; Vice-President, S. O. Houghton, Los Angeles, Cal.; Treasurer, L. R. Winans, Los Angeles; Secretary, A. B. Manahan, Pasadena; General Manager, Clarence W. Scott, Los Angeles; Chief Engineer, C. S. Masten, Los Angeles.

Southern Pacific.—W. S. Knapp has been appointed Superintendent of the Salt Lake Division, with headquarters at Salt Lake City, Utah, vice A. J. Fell, transferred.

Toledo, St. Louis & Kansas City.—A. L. Milk is now Chief Engineer, vice J. O. Osgood, resigned.

Union Pacific.—The following directors were elected at the annual meeting held this week in Boston: Charles Francis Adams, Frederick Ames, Elisha Atkins, Ez a H. Baker, Gordon Dexter, Mahlon D Spalding, Samuel Carr, Jr., of Boston; Henry H. Cook, Sidney Dillon, David Dows, Andrew H. Green, and Colgate Hoyt, of New York; Grenville M Dodge, Council Bluffs, Ia., James A Rumrill, Springfield, Mass., and John Sharp, Salt Lake City. The only change from last year's board is the election of Samuel Carr, Jr., to fill the vacancy caused by the death of Vice-President T. J. Potter.

Valley (Ohio).—The following directors were re-elected at the annual election last week: J. H. Wade, S. T. Everett, and D. L. King.

Western New York & Pennsylvania.—J. H. Poole has been appointed Purchasing Agent, with office in Buffalo, N. Y.

Winona & Southwestern.—D. M. Wheeler, of Minneapolis, has been appointed Chief Engineer, in place of John Williams, resigned.

Western North Carolina.—The following directors were elected at the annual meeting held this week in Winston, N. C.: George S. Scott, Calvin S. Brice, W. G. Oakman, T.

M. Logan, J. A. Rutherford, J. W. Fries, A. B. Andrews, J. C. Buxton, R. B. Glenn, T. B. Keogh, G. W. Hinshaw, H. W. Fries.

OLD AND NEW ROADS.

Anniston & Cincinnati.—The tracks of this road will be connected with those of the Alabama & Great Southern at Attala, Ala., in a few days. The road extends from Anniston northwest to Attala, 36 miles.

Atlanta & Alabama.—Organized to construct a road from Atlanta, Ga., to Selma, Ala. John H. Gordon, Atlanta, is one of the directors.

Augusta & Chattanooga.—The road is now being graded from Augusta, Ga., for about 20 miles toward Gainesville. A survey has been made from Augusta, via Gainesville, to Chattanooga, Tenn., a distance of about 250 miles, and profiles made. Clement A. Evans, Augusta, is President.

Baltimore & Ohio.—Work has been commenced on a branch to extend from Carroll, Md., to Clifford, on the Curtis Bay branch, and which will connect the Annapolis & Baltimore Short Line with the main line of the Baltimore & Ohio. The contract has been let to Jones & Thomas, of Baltimore.

The construction of the Berkeley Springs & Potomac, which will be built from the main line to Berkeley Springs, in Morgan County, W. Va., a distance of 6 miles, was commenced on the 16th. C. D. Longhorne, of Richmond, Va., is the contractor. A large number of new bridges are now being erected on different portions of the system, replacing the Fink and Bollman bridges with more modern structures.

Bangor & Portland.—A branch is being constructed from a point near Pen Argyle, Pa., to near Wind Gap, a distance of about 2½ miles. The contract has been let to Henry T. Hoffman.

Bellaire, St. Clairsville & Cleveland.—A survey has been made for an extension from St. Clairsville northwest to Sherroddsville, Carroll County, a distance of about 43 miles, and it is stated that the road will be built this summer. C. N. Troll, Bellaire, is the General Manager.

Camden, Gloucester & Mt. Ephraim.—The company is grading a line for a second track between Bulson and Lemon street, Camden, N. J., a distance of about a mile. Work on the Kaighn's Point Terminal road, which is to be constructed from Lemon street, Camden, to Kaighn's Point Ferry, will be commenced about May 1. This will give the company and the Williamstown & Delaware River road a new entrance into Camden.

The locating surveys will soon be commenced for an extension from Mt. Ephraim east to Spring Hills, in Burlington County, which will be built under the name of the Camden County Railroad. The capital stock has all been subscribed.

Cape Breton.—Construction work is progressing on that part of the line between Canso and Sidney, C. B., a distance of 100 miles.

Cape Fear & Yadkin Valley.—About five miles of grading has been completed on the Stokesdale & Madison branch, and it is thought that the whole line will be ready for tracklaying in the early part of August.

Carthage & Adirondack.—A branch from Jayville, N. Y., to Little River, a distance of 14 miles, is being constructed.

Castine & Bangor.—The survey has been made for this road from Bangor through Penobscot to Castine Harbor, Me. An iron bridge, 1,100 ft. long, over the Penobscot River at Bangor, will be needed. It is stated that contracts will be let in a month or two. James Adams, Bangor, is President.

Charleston, Cincinnati & Chicago.—The road has been completed between Camden and Lancaster, S. C., 40 miles, and regular trains are running from Charleston to Lancaster.

Chattaroi.—A survey is being made from a point about 3 miles north of Louisa, Ky., southeast to the Virginia State line. The road is part of the Charleston, Cincinnati & Chicago. S. A. Forbes, Ashland, Ky., is the Engineer.

Chesapeake & Nashville.—It is thought that the contracts will be let this year for an extension from Scottsville, the present terminus, northeast to Stanford, K., on the Louisville & Nashville, a distance of 152 miles, which has already been surveyed. Robert Meek, Gallatin, Tenn., is Superintendent.

Chesapeake & Ohio.—The line of passenger and freight steamers, running between Liverpool and Newport News, controlled by this company, has been discontinued.

Chicago, Madison & Northern.—A mortgage has been filed in Wisconson for $4,370,000 in favor of Edmund T. H. Gibson and Alexander G. Hackstaff, of New York, Trustees. The track and right of way of both the Dodgeville and Madison lines are covered by this mortgage, but it does not apply to rolling stock. The bonds it secures draw 5 per cent. interest per annum, and are payable Dec. 31, 1935. The road is 225½ miles in length.

Chicago, Milwaukee & St. Paul.—A cut-off, 32½ mile in length, is being constructed between Marion and Cedar Rapids, Iowa.

Chicago & West Michigan.—A survey has been made for an extension north from Baldwin to Traverse City, Mich., a distance of about 75 miles, which will, it is thought, be built this year.

Columbus Southern.—A large force will soon be withdrawn from the Chattanooga, Rome & Columbus and transferred to this road by the Chattahoochie Brick Co. of Atlanta, Ga., who have the contracts for building both lines. The road is to extend from Columbus, Ga., southeast through Cusseta, Richland, Weston and Dawson, to Albany, a distance of about 80 miles, on which the grading of the 23 miles between Albany and Dawson has been nearly completed. W. S. Greene, Rome, Ga., is Chief Engineer.

Current River.—This branch of the Kansas City, Springfield & Memphis has been completed this year from Birch Tree, Mo., northeast to Chicopee, near Van Buren, Carter County, a distance of 36 miles, and construction work is in progress to Grandin, 16 miles from Chicopee. James Reilly & Co., of Mills Springs, Mo., have the contract from Chicopee.

Decatur, Tupelo & Helena.—Chartered in Mississippi to construct a road from Helena in a general easterly direction through the northern part of the state to the Alabama state line. It is said that contracts will be let soon. Harry C. Medford, Tupelo, Miss., is Secretary.

Delaware & Hudson Canal Co.—The company is constructing 14 miles of double track on the Susquehanna Division. An iron coal terminal at Weehawken, N. J., is also being constructed.

Detroit, Lansing & Northern.—Work is progressing on the extension from Grand Ledge north by west to Grand Rapids, Mich., 50 miles. Eleven miles of this, between Mullikin and Lake Odessa, have been completed.

Duluth, Wilmar & Sioux Falls.—Shepard, Winston & Co., of St. Paul, who have the contract for building this road from Wilmar, Minn., southwest to Sioux Falls, Dak., a distance of about 150 miles, are actively pushing the work.

Emerson & Northwestern.—The company has applied for a charter to construct a road from the southern boundary of Manitoba at Emerson northwest to the main line of the Canadian Pacific and to a connection with the Manitoba & Northwestern at Portage La Prairie.

Florence.—The contract for constructing 10 miles of this road has been let to J. D. Harden, Marion, S. C.

Forest City & Southeastern.—The survey is being made for this road, which is projected to extend from Forest City southeast to Sioux Falls, Dak., a distance of about 200 miles, and it is thought that grading will be commenced in May. The general office is in Forest City.

Garden City, Conductor & El Paso.—Chartered in Kansas to construct a road from Garden City on the Atchison, Topeka & Santa Fe, in a southerly direction through the counties of Finney, Haskell, Grant, Stevens and Morton to the state line and then through the Indian Territory, New Mexico and Texas to El Paso. The capital stock is $1,000,000, and the headquarters will be in Garden City and Conductor.

Gulf, Colorado & Santa Fe.—Surveys are being made from Ballinger southwest to San Angelo, Tex., 36 miles.

Indiana & Illinois Southern.—A survey has been made from Newton, Ill., southwest to East St. Louis, and a survey is now being made from Lyonton, Ind., northeast to Indianapolis.

Indianapolis, Decatur & Springfield.—It is stated that funds to build the proposed extensions have been secured, and that work will soon commence.

Intercolonial.—A branch is being constructed from Oxford east to Pictou, N. B., a distance of about 70 miles.

Kansas City, Memphis & Birmingham.—A short two-mile branch is being constructed up the valley of Coal Creek (Alabama) to reach coal mines.

Kansas City & Southern.—Tracklaying on the extension to Kansas City has been commenced at Belton, Mo., on the Kansas City, Clinton & Springfield, and will be rapidly completed.

Kings County Elevated (Brooklyn).—The line was opened April 24 from Fulton Ferry and the New York & Brooklyn Bridge to Nostrand avenue, the temporary terminus. Trains ran up to midnight, and many thousands of passengers were carried. In the busy hours of the day four-car trains were insufficient to carry all the passengers who desired to travel, and twice as many trains then ran from the bridge as from the ferry. There was some difficulty in getting the four-car trains up the heavy grade from the ferry to the bridge, partly owing to the newness of the rolling stock. A pushing engine was used. The trip from the bridge to Nostrand avenue, a distance of about three miles, is made in 15 minutes. In the middle of the day two car trains were run. All the cars have cross seats in the centre, and these have high backs, so that one passenger's head does not interfere with another's. The travel in the street-car lines which centre in Fulton street was greatly lightened by the opening of the new route. All the elevated stations were open and used, but most of them are unfinished, the waiting rooms lacking the finishing touches.

Kingman, Pratt & Western.—A line has been surveyed from Greensburg, the present terminus, to Dodge City, Kan., a distance of 25 miles; but it has not yet been decided when the contracts will be let.

Kingston & Pembroke.—The company has under construction at Kingston, Ont., 59,000 sq. ft. of new wharf, the piles being all driven and the approach nearly completed ready for the track. The whole will probably be completed by July 1. This will give the company 2,300 lineal feet of additional wharf frontage.

Lincoln & Colorado.—A line is being surveyed from Plainfield, Kan., northwest, about 102 miles, to Colby, Kan., from which point construction is being pushed to the west line of Thomas County, 19 miles. At Plainfield a connection will be made with the Salina, Lincoln & Western, which is being extended to that point. Both roads are branches of the Union Pacific. The contractors are Kilpatrick Bros. & Collins, of Beatrice, Neb.

Little Rock & Fort Smith.—An extension has been completed from Van Buren, Ark., 48 miles west to the Illinois River, in the Indian Territory, and is being built to Fort Gibson, 23 miles further west.

Los Angeles County.—The contract for constructing the road between Sunset and Santa Monica, Cal., a distance of six miles, has been let to W. T. Spillman, and work will soon be begun.

Louisville & Nashville.—Engineers are surveying an extension north from Clarksville, Tenn., to Dixon, on the Nashville & Northwestern, a distance of 30 miles.

Lynchburg & Durham.—The contracts for constructing 60 miles of this road south from Rostburgh, Va., toward Durham, N. C., have been let as follows: To J. R. Surpell & Co., 10 miles; E. S. Moorman & Co., 10 miles; J. R. Surpell, 21st to 34th mile, inclusive; Carrington & Reily, 35th to 60th mile. The contractors are all of Lynchburg, Va. The contract for constructing 10 miles north from Durham was let to Carrington & Co., of that place. The road is to extend from Lynchburgh to Durham, 113 miles, of which 72 miles are in Virginia. J. W. Goodwin, Lynchburg, is Chief Engineer.

Manchester & Augusta.—The road is being constructed from Sumter, S. C., southwest to the Santee River, 18 miles, and the survey has been made to Augusta, Ga. It is a branch of the Wilmington & Weldon.

Marshall, Paris & Northwestern.—Sixteen miles of the road from Marshall, Tex., northwest, have been put in operation, and the grading from Paris, south, has been completed for 23 miles.

Meriden & Waterbury.—It is expected that the road will be completed and in operation in June or July, when it will be consolidated with the Meriden & Cromwell.

Mexico.—A concession has been granted for a narrow-gauge road to extend from Zamora to the port of Zihuatanejo on the Pacific ocean, passing through Uruapan in the state of Michoacan, Ario and Tacambaro. At Ario the road will connect with the Mexican National by a branch touching at Patzcuaro.

Midland.—A survey from the present terminus southwest to Rockville, Ind., on the Terre Haute & Indianapolis, will, it is stated, soon be commenced. H. Moore, Anderson, Ind., is Superintendent.

Milwaukee, Lake Shore & Western.—The extension northwest from Rhinelander to Hurley, Wis., has been located and the construction of that part of it between Rhinelander and the Flemenbeaux Indian Reservation, a distance of 27½ miles, has been commenced.

Minneapolis, St. Paul & Sault Ste. Marie.—Dispatches state that the Minneapolis, Sault Ste. Marie & Atlantic, Minneapolis & Pacific, and Aberdeen, Bismarck & Northwestern roads have been consolidated under this name, and that the papers will be executed next week. It is also stated that bonds have been issued to cover the three roads, in order to provide additional equipment and prosecute terminal improvements at Minneapolis, Gladstone, and Sault Ste. Marie, and that enough of the bonds have been placed to provide for present necessities.

Minnesota & Dakota.—The contract for building 100 miles of this road has been let to Job Voat & Co., of Wilmot, Wis. The survey has been made to New Rockford, on the Northern Pacific, 145 miles northwest of Fargo. Isaac Britton, Britton, Dak., is General Manager.

Missouri Pacific.—The Verdigris Valley, Independence & Western Division has been extended from Independence, six miles, to a connection with the Denver, Memphis & Atlantic. A survey is also being made from Fort Smith, southeast to Gurdon, Ark., on the St. Louis, Iron Mountain & Southern, a distance of about 150 miles. Tracklaying is in progress from the east line of Saline County to Boonville, Mo., a distance of 17 miles.

Missouri, Tennessee & Georgia.—It is stated that the company is making arrangements for the construction of its road, which is projected from a point on the Mississippi River, opposite New Madrid, Mo., to Humboldt, Tenn., a distance of about 50 miles. C. H. Ferrell, Humboldt, is Treasurer.

Narragansett Pier.—The company has laid 8¼ miles of track this year between Kingston and Narragansett Pier, R. I., and is also surveying a line to South Ferry, 4½ miles from Narragansett Pier.

Nashville & Knoxville.—Tracklaying has been completed east from Lebanon, Tenn., on the Nashville, Chattanooga & Tennessee, to Shop Springs, a distance of seven miles, and is progressing toward Cookeville.

New Castle & Shenango.—It is stated that the New York, Pennsylvania & Ohio has secured the right of way of this road and will complete it to Pittsburgh.

New Orleans, Natchez & Fort Scott.—The contract for building this road has, it is stated, been let to a firm in Chicago. The company proposes to construct a road from New Orleans to Hot Springs, Ark., via Natchez, Miss. John N. Rice, Fort Scott, Kan., is President.

New Roads.—A road is projected from Bridgewater, Oneida County, N. Y., on the Delaware, Lackawanna & Western, southwest about 16 miles to Brookfield, Madison County, via South Brookfield, West Edmeston, Leonardsville and Unadilla Forks. Walter F. Randall, Oneida, is interested.

A road is projected from Darlington to Hartsville, S. C., about 15 miles.

New York, Lake Erie & Western.—This company has made arrangements with Drexel, Morgan & Co. to extend for 40 years the fifth mortgage bonds, issued by the New York & Erie, maturing June 1, at three per cent. per annum. Holders not desiring to extend will have principal and accrued interest at seven per cent. to June 1, 1888, payable at the office of Drexel, Morgan & Co., New York, on and after that date. Those desiring to extend their bonds and depositing them with the firm will have the privilege until June 15 of purchasing at 102 and interest, bonds extended by the firm after purchases from present holders. It is thought that the railroad company will save about three per cent. upon the principal of the mortgage by this plan.

Olympia, Gray's Harbor & Baker Bay.—Incorporated in Washington Territory to construct a road from Olympia west to a point on Baker Bay, to connect with Gray's Harbor and other points. The capital stock is $1,000,000. The general office is to be in Olympia.

Oregon Railway & Navigation Co.—The contracts have been let to Kilpatrick Bros. & Collins, of Beatrice, Neb., to grade and bridge the Eureka Flat Branch, from Wallula to Estes, a distance of 40 miles, and the Willow Creek & Heppner Branch from the mouth of Willow Creek to the town of Heppner, a distance of 45½ miles. Work will commence on both branches in a few days, and is to be completed before September 15.

Pennsylvania.—It is reported that officials of the Pennsylvania are negotiating for the control of the Cincinnati, Richmond & Chicago road, which they now have in common with the Cincinnati, Hamilton & Dayton. This would give them a through line of their own from Cincinnati to Chicago. The road extends from Hamilton, O., to Richmond, Ind., connecting at Richmond with the Chicago, St. Louis & Pittsburgh.

The road is being graded between Vineyard and Mt. Union, Pa., on the middle division, a distance of four miles, for a fourth track. P. McManus, Philadelphia, Pa., is the contractor.

Pine Bluff, Monroe & New Orleans.—Surveys have been made from Rob Roy to Rainey, Jefferson County, Ark., 16 miles, of which five miles have been graded and the right of way secured except six miles, near Rainey. It is stated that a survey to Monroe will soon be commenced.

Pittsburgh & Lake Erie.—An extension of the second track, 3½ miles to Coraopolis, Pa., is being made.

Pittsburgh, Shenango & Lake Erie.—An extension has been completed from Greenville to Amasa, Pa., on the Franklin branch of the Lake Shore & Michigan Southern, a distance of 3½ miles, including a 160-ft. span bridge near Greenville. Work on the extension to Lake Erie will be commenced in May.

Providence, Warren & Bristol.—A second track is being constructed between Nayatt and Barrington, R. I. The road will also be double tracked between Silver Springs and East Providence, 2 miles.

Raritan River.—The contract for building this road has been let to J. L. Bateman, Saratoga, N. Y., and it is stated that work will soon be commenced. The road is to extend from South Amboy, N. J., to New Brunswick, and then following the Raritan River to Bound Brook, a distance of about 18 miles.

Richmond & Danville.—The Western North Carolina division has been extended from Jarrett's, N. C., in the extreme southwest part of the state, to Red Marble Gap, a

distance of three miles, and is now being extended to Murphy, N. C., on the Marietta & North Georgia, 30 miles from Jarrett's. Work is progressing on the extension from Wenston and Sallin, west to Wilkesboro, N. C., 75 miles.

Rockwood & Kingston.—Incorporated in Tennessee to build a railroad from Rockwood on the Cincinnati Southern, to Kingston, by W. E. McElwee, J. A. Sewell, and others.

St. Louis, Arkansas & Texas.—It is thought that work will be commenced in a month or two on the extension north from Malden to St. Louis, Mo., a distance of about 145 miles, the survey for which has already been made.

Salina, Lincoln & Western.—Construction work is progressing on this branch of the Union Pacific, from Waldo, Kan., northwest to Plainville in Rooks County, a distance of 3 0 miles.

South Atlantic & Ohio.—Contracts will soon be let for grading about 28 miles of this road. W. E. Chamberlain, Bristol, Tenn., is General Superintendent.

Staten Island Rapid Transit.—An extension to connect the road with the Arthur Kill Bridge has been made from the present terminus on South Avenue. About 1¼ miles will be trestle and half a mile of grading. On the New Jersey side a line has been surveyed to connect with the Central of New Jersey. Contracts will soon be let.

Toledo, Saginaw & Mackinaw.—Surveyors are reported to be running a line from East Saginaw, north to Bay City, Mich., on Saginaw Bay, a distance of about 10 miles. It is also stated that tracklaying will commence in about a week, at North Durand and East Saginaw. William Doheny, East Saginaw, Mich., is Superintendent.

Valley (Ohio).—A short branch is being constructed from Mineral Point, O., on the main line, to the mines near Huff Run.

Wabash.—The Purchasing Committee is making satisfactory progress in the plans for the reorganization of the road and has now received the assent of three-fourths of all the outstanding bonds on the lines east of the Mississippi, and a majority of every one of the many different mortgages. The foreclosure proceedings will probably begin shortly.

Western Counties.—It is stated that £678,000 of the debentures of this Nova Scotia road have been subscribed in London. These securities are part of an issue of £568,000, of which the remaining £182,000 has been appropriated to the payment of existing liabilities. The net proceeds of the £678,000 is to be applied to the construction of a road from Digby, the present terminus (67 miles from Yarmouth), to Annapolis, also to provide for betterments, and to provide an annuity of 4 per cent per annum for 30 years, 3½ to be applied to interest and ½ to the sinking fund. The general office of the company is in Yarmouth, N. S.

Western of Florida.—An extension has been made from Bellmore City, Clay County, Fla., east about 2 miles toward Starke in Bedford County, on the Florida Railway & Navigation Co.'s road, and four miles more have been graded. Surveys are being made to complete the main line to Melrose and the branch to Starke.

Western Maryland.—Surveys for an extension from Emmittsburg, Md., north to a connection with the Gettysburg & Harrisburg, at Gettysburg, Pa., are contemplated, though nothing definite will be done for some time.

Western New York & Pennsylvania.—Subscription books have been opened by Maitland, Phelps & Co., and Kessler & Co., of New York, for an issue of $7,700,000 first mortgage five per cent. 50-year bonds at 97 and accrued interest. They are a first lien upon the property of the reorganized Buffalo, New York & Philadelphia, which property represents a cost to the company of over $30,000,000, and are issued at the rate of about $15,500 per mile. The total amount of the mortgage is $10,000,000, of which $2,300,000 are reserved for betterments, construction of additional railroad, and to take up the bonds of the Warren & Franklin, maturing in 1896. A simultaneous issue of the bonds is made abroad, also in Philadelphia, Boston and Buffalo.

Wilmington & Weldon.—The Scotland Neck branch has been extended from Scotland Neck, N. C., five miles.

Yankton & Southwestern.—It is stated that surveys will soon be made from Yankton to Norfolk, Dak.

TRAFFIC AND EARNINGS.

Colorado Rates.

The reduction in freight rates to Colorado points to meet the tariff made from Gulf ports and from New York *via* those ports is announced as follows:

Between Chicago and Colorado points:

	First class.	Second class.	Third class.	Fourth class.	Fifth class.
New rates	$1 80	$1.46	$1.34	$1.12	$.90
Old rates	2.45	2.05	1.55	1.25	1.05
	Class A.	Class B.	Class C.	Class D.	Class E.
New rates	.90	.81	.70	.60	.50
Old rates	$1.20	.95	.75	.62½	.56

Between Missouri River and Colorado points:

	First.	Second.	Third.	Fourth.	Fifth.
New rates	$1.30	$1.10	$1.05	.90	.75
Old rates	1.70	1.45	1.15	.95	.80
	A.	B.	C.	D.	E.
New rates	.75	.65	.55	.45	.40
Old rates	.90	.70	.55	.45	.40

The new rates between New York and Colorado points by the trunk lines are $2.20, $1.85, $1.60, $1.30, $1.10, $1.10, 95, 85 and 75. The reduction on first-class is 87 cents per 100 pounds and correspondingly on other classes.

It will be noticed that the roads east of the Missouri bear a large share of the reduction and that those east of Chicago apparently do the same.

Coal.

The statement of the coal tonnage of the Philadelphia & Reading for the week ending April 21 amounted to 144,399 tons, an increase of 8,610 tons over the same period last year. The total tonnage for the year amounted to 1,918,589 tons, a decrease of 661,402 tons, compared with the same period in 1887.

On the United Railroads of New Jersey Division the anthracite coal tonnages for the same periods were as follows

	1888.	1887.	Decrease:
Week ending April 14	31,933	6,176 D.	1,242.
Year to April 14	460,311	512,9 8 D.	52,617

The coal tonnages of the Pennsylvania road originating on lines east of Pittsburgh and Erie, for the week ending April 14 and the year to that date are as follows:

Total for week ending April 14,			
1888	231,756	268,849	300,605
Total for year 1888 to date	3,287,265	1,111,344	4,498,609
Total for year 1887 to date	2,991,593	1,294,280	4.285,873

Railroad Earnings.

Earnings of railroad lines for various periods are reported as follows:

Three months—Jan. 1 to March 31:

	1888.	1887.	Inc. or Dec	P.c.
Atlantic & Pac	$622,912	$626,758	D. $3,846	0.6
Buff.. R. & Pitts.	454,379	415,861	I. 38,515	9.3
Bur., C. R.& Nor.	638,856	703,021	D. 64.165	9 1
Cairo, V. & Chic.	165,828	172,030	D. 6,202	3.5
California South.	470,983	384,081	I. 86,902	22.6
Canadian Pac	2,585,199	1,873,394	I. 711,805	38.5
Cent. of Georgia.	1,342,271	1,143,337	I. 198,934	17.4
Central of Iowa	329,633	340,080	D. 10,447	2.9
Ches., O. & S. W.	476,740	422,605	I. 54,135	12 8
Chic. & Atlantic	453,238	524,756	D. 71,518	13.5
Chi. & East. Ill.	479,679	465,694	I. 13,985	3.2
Chi. & Ind. Coal.	133,527	91,493	I. 42,034	46.1
Chi., Mil. & St. P.	4,960,000	5,227,898	D. 267,898	5.3
Chic. & Ohio R	10,210	17,606	D. 7,396	41.2
Chi.,St. P.& K.C.	424,190	263,992	I. 160.198	60.6
Chi. & W. M	296,977	308,131	D. 11,154	3.6
Cin., J. & Mack	105,480	95,350	I. 10,130	10.5
Cin.,N. O. & T. P.	846,501	790,300	I. 56,201	7.1
Ala. Gt. South.	393,118	371,508	I. 21,610	5.6
N. Orl. & N. E.	219,339	177,480	I. 41,859	23.9
Vicks. & Mer.	128,483	139,411	D. 10,928	7.9
V., Shre. & P.	137,237	145,443	D. 8,206	5.5
Cin., R. & Ft. W.	99,158	93,329	I. 5,829	6.4
Cin. & Springf'd.	270,524	253,875	I. 16,649	6.3
Cape F. & Y. V.	82,930	67,689	I. 15.241	22.4
Cleve. & Canton.	83,858	78,120	I. 5.738	6 4
Cl., C., C. & I	942,332	957,773	D. 15,441	1 6
Whole System.	1,720.777	1,745,667	D. 24,890	1.4
Det., B. C. & Al.	100,531	90,248	I. 10,283	11.1
N. Y., S. & West.	342,545	295,475	I. 47,070	16.0
South Carolina	382,698	326,799	I. 55,899	17.1
Cin., W. & Balt.	511,883	539,253	D. 27,370	5.2
Cleve.,Ak. & Col.	139,451	122,907	I. 16,544	13.0
Cleve. & Mar	68,627	77,189	D. 8,562	10.4
Col. & Cin. Mid.	70,782	76,282	D. 5,500	2.5
Col., H. V. & T.	583,542	667,796	D. 84,254	12.5
Den. & R. G	1,597,437	1,701,211	D. 103,874	6.1
Den. & R. G. W.	275,358	226,822	I 48,536	21.2
Det., Lan. & No.	208,197	246,890	D. 38,693	15.8
Du.. S. S. & At.	222,877	159,776	I. 72.101	48.0
E. Ten., Va. & G	1,369,280	1,233,152	I. 136,128	11.0
Ev. & Indianap.	52.111	56,996	D. 4,885	87.0
Ev. & Terre H	200,360	181,394	I. 18,966	10.5
Flint & P. M.	589,084	583,526	I. 5,558	1.0
Fla. Ry. & N. Co.	278,981	279.027	D. 46	0.02
Georgia Pacific.	313,044	263,079	I. 49,965	19.0
Gr. Rapids & Ind.	501,635	502,040	D. 405	0.08
Other lines	45,965	27,032	I. 18,933	70.3
Grand Tr.of Can.	3,706,340	4,231,848	D. 525,508	12.4
Houston & T. C.	521,471	583,174	D. 61,703	10.5
Hum. & Shen	36.161	36,637	D. 476	1.3
Ill.C..(I.& S.Div.)	2,615,951	2,750,351	D. 34,400	1.2
Cedar F. & M.	19.672	25,985	D. 6,313	25.1
Dub. & Sioux C.	209,931	186.749	I. 23,182	12.3
I. F. & S. City.	172,431	152,910	I. 19,521	13.0
Ind., Dec. & Spr.	77,627	109,137	D. 31,510	28 4
*K. C., Ft. S. & G.	532.331	582,814	D. 46.483	7.9
*K.C..Sp. & Mem.	369.410	427.879	D. 58,469	13.5
*K C.,Cl. & Spr.	53,726	57.649	D. 3,923	7.7
Kentucky Cent	220,194	208,650	I. 11,544	5.3
Keok. & West	78,080	77,245	I. 835	1.1
Kingston & Pem.	35.277	23.774	I. 11,503	47.8
Lake E. & W	442.346	476,769	D. 34,423	7.3
L. Rk. & M	190,010	221,446	D. 22,436	9.9
Long Island	518,193	509,443	I. 8,750	1 5
Lou., Ev. & St. L.	224,354	219,040	I. 5,314	2.3
Louiv. & Nash	3,832.482	3,724,717	I. 107,765	2.9
L., N. A. & Chi.	449 877	475,338	D. 25,461	5.3
L. N. O. & Tex.	641,376	550,172	I. 91,204	16.5
Mar., Col. & Nor.	21,886	11,480	I. 10,406	90.9
Memphis & Chas.	426,535	409,437	I. 17 098	4.1
†Mexican Central	1,544 706	1,208,557	I. 336,149	27.8
†Mex. National	534.601	437,196	I. 97,405	22.2
†MexicanRailway	962,297	851,524	I. 110,773	12.9
Mil., L. S. & W.	445,590	549.234	D. 103,644	18 7
Mil. & Northern.	220,823	214,843	I. 5,980	2.8
Minn. & St. L	300,834	383,282	D. 82,448	21.4
Mobile & Ohio	616,248	625,979	D. 9,731	1.4
Nash., C. & St. L.	776,773	737,288	I. 39,485	5.3
Nat.,Jack. & Col.	41,328	42,429	D. 1,101	2.4
N. Y. C. & H.R.	8,152.796	8,089,351	I. 63,445	0.8
N. Y., Ont. & W.	324,112	281.434	I. 42,678	14.9
Norfolk & West	1,123 978	875,337	I. 248.641	28 3
Northern Pacific.	2.827,437	2,127.828	I. 699.609	32.9
Ohio & Miss	889,721	996,944	D. 107,223	10.7
Ohio River	79.943	51.715	I. 28,228	54.9
Ohio Southern	161,349	150,860	I. 10.489	6.6
Oregon R.& N.Co.	1,275.245	972,202	I. 303,043	31.1
Pitts. & West	396,264	447,002	D. 50,738	11.2
Rich. & Danv	1,208,614	1,068.878	I. 139,736	13.0
Va. Mid. Div	392.271	341,301	I. 50,970	14.9
Char., C. & A.	257.316	224,571	I. 32,745	14.3
Col. & Gr. Div.	180,793	161,404	I. 19,389	11.9
West. N. C.Div.	163,965	154,969	I. 8,996	5.9
W. O. & M. Div.	23,200	19,837	I. 3.363	15.8
Ashev. & Spa	24,149	10,034	I. 14.115	140.0
‡St.L.A.&T.H.M.L	480,297	505,360	D. 25,063	4.9
Branches	227,227	217,492	I. 9,735	4.1
St. L., A. & T	638,935	513,529	I. 125,406	24.3
St. L. & San F.	1,233,924	1,331,262	D. 97,338	7.3
St. P. & Duluth.	236,168	270,533	D. 34,365	12.6
St. P., M. & Man.	1,774,165	1,573,863	I. 200,302	12.9
San A. & Aran.P.	189,388	73,595	I. 115,793	157.5
Shenandoah Val.	179,562	185,701	D. 6,139	3.2
Staten Is. R. T	126.993	125,565	I. 1,428	0.8
Texas Pacific	1,491,548	1,506,706	D. 15,158	0.9
Tol.,A. A.& N. M.	142.515	121,295	I. 21,220	17.4
Tol. & O. Cent.	289,951	242.527	I. 47,424	29.4
Tol., P. & West	208,246	225,565	D. 17,319	7.6
Wabash West	1,107,882	1,469,363	D. 271,481	18.4
West. N. Y. & P.	654 423	591,276	I. 63,147	10 6
Wheeling & L. E.	215,801	169,353	I. 46,448	27.2
Wisconsin Cent.	768,207	780,748	D. 12,541	1.5
Total	$73,496,216	$70,779,385	I. $2,716,831	3.8

* Includes three weeks only of March in each year.
† Mexican currency.
‡ Including Indianapolis & St. Louis.

Early reports of monthly earnings are usually estimated in part, and are subject to correction by later statements.

The statement of the earnings of the Elizabethtown, Lexington & Big Sandy for February shows:

	1888.	1887.	Inc.
Gross earnings	$74,499	$68.419	I. $6.079
Op. expenses	59,679	59,236	I. 443
Net earnings	$14,819	$9,183	I. $5,636

Traffic Notes.

The general managers of the lines in the Central Traffic Association have voted to ask the Inter-state Commission to require all water carriers issuing through rates or bills of lading over connecting railroad lines to file such tariffs with the Inter-state Commission, showing the divisions of the rates as between water carriers and their connecting rail lines. At the meeting it was also resolved "That the chairman be instructed to ask the Inter-state Commerce Commission for a ruling (or law) that will require every bill of lading or waybill to show the actual points of origin and destination and route of shipments, and which shall further provide that no such way-bill or bill of lading be thereafter changed except upon the actual written order of the owner of the property, a duplicate of which order shall be attached to the way-bill.

The roads in the Western States Passenger Association now sell excess baggage coupon books of the face value of $12.50 for $10.

The roads interested have agreed on rates on pig iron from Ashland, Wis. to prominent western points, a blast furnace going into operation at that place this week for the first time. The rates per gross ton are: To Milwaukee, $2.50: to Chicago, $2.75; to St. Louis and Omaha, $3.85, and to St. Paul, $1.75.

The *News-Herald*, of Jacksonville, Florida, states that the Railroad Commission of that state has revised the schedule of maximum passenger rates on the roads of the state allowing the roads to charge higher fares. Those which have heretofore been limited to 3 cents are allowed to charge 4, and the 4 cent limit is raised to 4½.

ANNUAL REPORTS.

The following is an index to the annual reports of railroad companies which have been reviewed in previous numbers of the current volume of the *Railroad Gazette:*

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Union Pacific.

The following extracts from the report for the last calendar year are published in advance of the full report:

The mileage operated is 4,763 miles, of which the Union Pacific proper is 1,824, and auxiliary lines 2,939. Included in the latter is the Oregon Railway & Navigation Company's 752 miles. The mileage of the Union Pacific proper has decreased 8 miles, 1,832 miles having been operated in 1886.

The earnings for the year were as follows:

Union Pacific Railway Co.

	1887.	1886.
Gross earnings	$19.546,088	$17,806.133
Expenses	9.869 616	9,085.771
	$9,676.472	$8,120.362
Taxes	564,586	597,654
Net earnings	$9 111.886	$7,522.708
Per cent. of expenses	53.38	57.75

Auxiliary Lines.

Gross earnings	$9.011,677	$8 474.053
Expenses	6,747,145	6,673.809
	$2,264.532	$1,800.244
Taxes	486,385	454.979
Net earnings	$1.778,147	$1,345,265

Union Pacific System.

Gross earnings	$28,557.766	$26.280 186
Expenses	16.616,761	16,359,580
	$11,941,005	$9,920,606
Taxes	1,050.971	1,052,634
Net earnings	$10,890 034	$8,867.972

On the entire system, embracing all auxiliary lines, the gross earnings increased from $26,280,186 to $28.557,765, while operating expenses increased but slightly, leaving net earnings of $10,890,034 against $8,867,972 in 1886. The percentage of expenses on the system was 61.87, while in 1886 it was 66.26. These are the best figures known since 1883.

The balance applicable to dividends on Dec. 31, 1887, was $3,169,729, or 5.20 per cent. upon the capital stock of the Union Pacific Railway Co. "in order to reach a correct basis of comparison between the financial results of the entire system for the two years 1886 and 1887," there is deducted from the 1886 income the proceeds of the sales of the Kansas Pacific land grant. This deduction being made, the income of the entire system in 1887 was $2,577,862, or $591,867 less than the income of 1886.

At the end of 1886 the funded debt aggregated $148,870,393, and the floating debt was $1,351,190, a total of $147,519,203. At the end of 1887 the funded debt was $147,590,911, and the floating debt was $401,689, a total of $147,189,222. Since 1884 the funded debt has been decreased $955,549, and the floating debt $7,301,867, a total decrease in the debt of $8,257,416. Meantime the mileage has increased 351 miles, making a decrease per mile in the company's debt of $4,320.

The gross floating debt was $7,464,443, against which there were bills and accounts receivable $6,273,955, all of which are stated to be good, except $174,784, due from the coal and stone department, which will have to be charged off. The curtailment of the free-pass system, in pursuance of the Inter-state Commerce act, has cut off 45 per cent. of the non-paying travel.

During the year the construction account has been increased $6,818,794, of which $5,580,079 was invested chiefly in the construction of new branches or extensions, and $1,238,713 was spent for new construction and equipment for the company's main lines. There have been built 350 miles of additional road. Of the foregoing amount ($6,818,794) about $448,000 was derived from the sale of the company's securities and $3,600,000 from earnings; $2,700,000 was provided for in other ways, chiefly through temporary loans.

At present little new construction is going on. Neither is it proposed to enter upon such construction until either a settlement is effected with the Government, or some general financial plan is adopted for meeting the cost of such work in advance of entering upon it.

The report refers to the recent Congressional inquiry into the affairs of the Pacific Railroads, and points out that the officers of the Union Pacific Company were not consulted by the commission as to a feasible scheme for readjusting the company's relations with the Government. Not until the report of the special commission was made and submitted to Congress and there referred to committees of the House and Senate was an opportunity afforded the officers of the road to express their views upon a measure of vital consequence to it, or to attempt in any respect to modify it. This fact is of importance, as it has frequently been alleged that the measure prepared by the Commission was in fact the measure outlined and advocated by the representatives of the company. Such was not the case. The measure reported by the Commissioners was wholly the result of their own labors and investigations. Indeed, had the officers of the company been permitted a hearing in the matter, as is customary where private parties alone are involved, the measure recommended would not improbably have been of a quite different character. As the result of discussions before the House committee, it underwent some modifications, and finally was reported on March 7, as the so-called "Outhwaite bill," and is now pending before the House of Representatives. This measure is the Government's own scheme of settlement, wholly irrespective of any action of the company or its representatives. As such, it is hoped that some final action upon it will be had during the present Congress."